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The Journal of APPLIED PSYCHOLOGY

EDITORS

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Ohio University

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WITH A

BOARD OF CO-OPERATING EDITORS

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COLLEGE STUDENT PERSONNEL PROBLEMS

I. Individual Mental Testing at the College-Adult Level

R. A. BROTEMARKLE

University of Pennsylvania

The College Personnel Programme at the University of Pennsylvania is the natural outgrowth of several years of clinical examinations and experimentation. A number of Instructors, Laboratory Assistants and Research Students in the Department of Psychology have assisted in the development of test procedure, and scoring, and in the securing of adequate standards for numerous individual tests. The work has been done in the Psychology Laboratory and Clinic and in connection with the courses in Psychology in the College, School of Education, School of Finance and the Graduate School. Several studies from varied view-points and by differing statistical methods have led to the development of the present materials. It is the author's purpose, at this time, to present the summary of the progressive series of studies and the Mental-graph Types, along with available standards for the College-Adult Level Individual Tests. In a second paper the author will present the Revised Forms of the Student Personnel Record and the Student Questionnaire, which plays so large a part in the social examination and rating of the individual.

A STATISTICAL STUDY BY THE SIGMA-MASSED METHOD

The first analysis of the Student Personnel Problem revealed a great need of Individual Clinical Test materials. Certain mental, emotional and social factors were investigated with available materials.

A group study of four hundred cases, equally distributed between the male students in the College and the male and

female students in the School of Education, was made during the year 1925–1926 in connection with the fundamental course in Mental Analysis and Clinical Tests and Measurements. The student academic grades were evaluated on the percentage basis and averaged. The grades used in the College records are *D* for Distinguished, *G* for Good, *P* for Passing or Satisfactory, *N* for Not Passing or Unsatisfactory, and *F* for Failure. The following values were assigned each grade; *D*, 95 per cent; *G*, 85 per cent; *P*, 65 per cent; *N*, 45 per cent; *F*, 35 per cent. The average of the total work accomplished by each student in his first class-room contact with the subject was used as the Academic Success Rating, or College Grade.

A Mental Competency Rating was obtained from the scores secured in several Specific Ability Tests. Three Ausfrage tests, the Taylor Number Test for the Distribution of Attention, three Memory Span Tests for Digits, Syllables and Ideas, and a Description Test, were used in the field of Attention. A Difference and Likeness, an Opposites and a Definition Test were used in the field of Discrimination. The Trabue Language Scale J and K, the Humpstone Memory Test, and the Fundamentals Test No. 7 of the Courtis Arithmetic Test, Series A Form 3, added certain Complex Processes to the former Fundamental Factors. These tests have all been reported previously by Miller, Viteles and Brotemarkle in studies, and by the authors of the tests also. The tests were given and scored under standard procedure and sigma-massed averaged to attain a single rating, the Mental Competency Rating. The sigmatised values assigned each test score, and by which it was multiplied for weighting in the total score, was as follows: Ausfrage A, 2; Ausfrage B, 2; Ausfrage C, 4; Distribution of Attention, 2; Memory Span for Digits, 5; Memory Span for Syllables, 2; Memory Span for Ideas, 5; Difference and Likeness, 6; Definitions, 5; Opposites, 4; Language Ability, 2; Memory, 2; and Arithmetic Achievement, 1.

Three Emotional tests were given and scored under standard procedure. The Downey Will-Temperament Group test, the Pressey X-O test and the Brotemarkle Comparison test for the

Ideational Content of Moral Concepts. An Emotional Rating was secured by the sigma-massed average of the four scores, the Downey Total score, the Pressey Total Affectivity and Total Idiosyncrasy, and the Brotemarkle Total Deviation score. The sigmatised value assigned each test score and by which it was multiplied for weighting in the total score was as follows: Downey, 4; Pressey Affectivity, 1; Pressey Idiosyncrasy, 5; Brotemarkle Deviation, 5.

A General Intelligence Rating was secured through the sigma-massed average score of two Group Tests; the Princeton Series V General Intelligence Test, a verbal test, and the International General Mental Test, a non-verbal group test. The latter test was used for the first time at the College level. The sigmatised value assigned each test score and by which it was multiplied for weighting in the total score was as follows: the Princeton Series V, total score correct, 1; the International General Mental Test, total score correct, 2.

A Social Rating was secured by a massed average of certain ratings attained by means of a Student Personnel Questionnaire (to be presented in the next article). The student was asked to rate certain Hereditary or Constitutional and certain Environmental or Conditional factors in his growth and development. The ratings were made upon a five-point scale or reduced to the same later. The various factors having to do with the rating of the Parents, the Parent's Social rating, the Parent's Vocational rating, and other factors, were first sigma-massed averaged and a single rating secured. The Parent's Educational ratings, and the Home environmental factors were sigma-massed and an averaged rating secured. The Neighborhood rating, the Library Facilities and Use ratings, the Student's College and High School Social activities ratings, and the Student's Economic ratings were then massed with the two former ratings and an average secured. This was used as the Social Rating.

The following correlations are based upon the above Ratings:

r—College Grades and Mental Competency Rating	+0.15
r—College Grades and Emotional Rating	+0.02
r—College Grades and General Intelligence Rating	+0.24
r—College Grades and Social Rating	+0.15
r—Mental Competency Rating and Emotional Rating	+0.04
r—Mental Competency Rating and General Intelligence Rating	+0.16
r—Mental Competency Rating and Social Rating	+0.05
r—Emotional Rating and General Intelligence Rating	+0.004
r—Emotional Rating and Social Rating	+0.0003
r—General Intelligence Rating and Social Rating	+0.015

R—College Grades and Mental Competency Rating, General Intelligence Rating, Emotional Rating, Social Rating ... +0.29

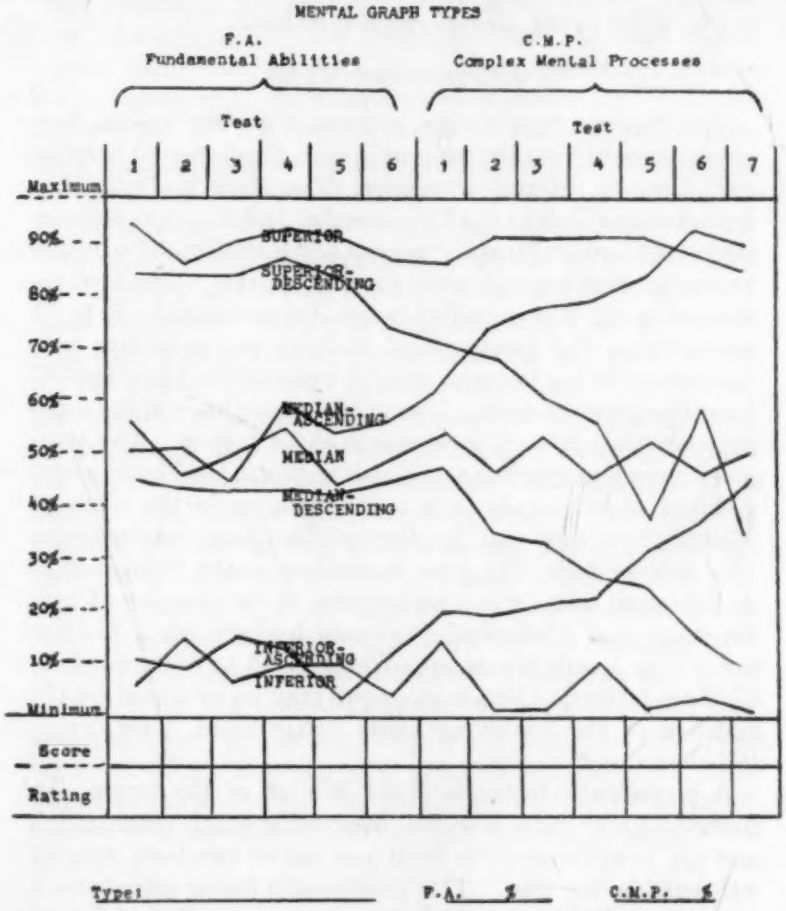
The tendency of the correlations indicates a reasonable discreteness in the materials used. The Multiple Correlation is of significance though low in indicative value. The study established two facts; first, that such value as might be found in the individual materials required a definite form of evaluation and interpretation in individual clinical analysis, in which the abilities and defects might be developed and integrated in a compensatory way; and second, that a further development was especially indicated in the treatment and arrangement of the individual mental testing materials.

THE MENTAL-GRAPH

During the summer session of 1926 the following method of Mental Competency Analysis was evolved as reported at the annual meeting of the American Psychological Association in December, 1926. The term Psycho-graph was conceived as inclusive of the Physical, Mental, Emotional and Social studies of the individual. The term "Mental-graph" was, therefore, used to designate a graph study of the Mental ability of the individual. The Mental-graph is composed of a percentile

distribution in graphic form, and enables the examiner to depote several types at College Adult Mental Level.

The following composite represents the general form and Types of the Mental-graph. The Fundamental Abilities have



been separated from the Complex Mental Processes. The former, including Attentional, Memory Span and Discrimination factors, is indicative of the earlier childhood and grade school development. The latter, including Language Ability,

Memory, Judgment, etc., are indicative of the adolescent and high school development of the mental backgrounds. In conjunction with the Mental Complex Processes a percentile rating of Intelligence materials, Intellectual or Informational test materials and Emotional test materials are also rated, though not included in the Mental-graph type itself.

MENTAL-GRAPH TYPES

The Superior type ranges in percentile distributions from approximately 85 to 100 per cent in both Fundamental Abilities and Complex Mental Processes. The Superior-Descending type standing high in the Fundamental Abilities, and descending in the Complex Mental Processes and Intellectual-Emotional backgrounds to approximately the median level. The Median-Ascending type has a median range of approximately 40 to 60 percentile in the Fundamental Abilities and ascending to a higher level in the Complex Mental Processes and Intellectual-Emotional backgrounds. The Median type has a standing of approximately 40 to 60 percentile in all the factors. The Median-Descending type has a median standing in the Fundamental Abilities and descends to a lower standing in the Complex Mental Processes and Intellectual-Emotional backgrounds. The Inferior-Ascending type stands low in the Fundamental Abilities and ascends to a higher level in the Complex Mental Processes and Intellectual-Emotional backgrounds. The Inferior type stands low at approximately 15 to 0 percentile in all three factors. Certain diagnoses may be enhanced by the addition of the qualifying terms "High" and "Low;" e.g., "Median Low."

A problematic factor is found in each of the types. An individual may have a widely fluctuating graph ranging high and low in either or both fields and one or two tests ranging well outside the type. This problematic factor introduces a tricky low ability into a given mental reaction. Being without the control of the individual, it may cause difficulty in almost any mental operation.

A further problem is also indicated at approximately the 20

to 30 percentile basis; this being the point at which a question of Junior College Level Ability and College Adult Level Ability arises.

A study of the Mental-graph factors and the Mental-graph Type is based on approximately one hundred cases in the Summer School in 1926. The individuals included were almost equally distributed between male and female of the College Adult age-level. The following correlations are indicated between the Mental-graph Type and its component factors, the Fundamental Abilities, the Complex Mental Processes and the Intellectual-Emotional Factor. The Fundamental Ability Rating is the sigma-massed average secured from the scores of the following tests: Aussage test, Ausfrage test, Observation test, Taylor Number test, Memory Span tests for Digits, Syllables and Ideas. The sigma weighting, based upon the Ausfrage test, Taylor Number test as unitary is multiplied six-fold for the Aussage test, the Observation test, and Memory Span for Syllables, and multiplied fourteen-fold for Memory Span for Digits and Ideas. The Complex Mental Process Rating is the sigma-massed average secured from the following tests: Memory test, Trabue Language test, Roback Opposites test, Description test, Roback Judgment test, Roback Reference test, Roback Abstraction test, and Roback Application test. The sigma weighting based upon the Appliction test as unitary, is multiplied two-fold for the Memory test and Judgment test, is multiplied three-fold for the Abstraction test, multiplied eight-fold for the Trabue Language test and Reference test; multiplied ten-fold for the Description test, and multiplied thirteen-fold for the Opposites test. The Intellectual-Emotional Rating is secured from the Deviation Score of the Brotemarkle Comparison test for the Ideational Content of Moral Concepts.

r—Mental-Graph Type and Fundamental Ability Rating. +0.62
r—Mental-Graph Type and Complex Mental Process Rating..... +0.43
r—Mental-Graph Type and Intellectual-Emotional Rating..... +0.41

r—Fundamental Ability Rating and Complex Mental Process Rating..... +0.41
r—Fundamental Ability Rating and Intellectual-Emotional Rating..... +0.26
r—Complex Mental Process Rating and Intellectual-Emotional Rating..... +0.36

R—Mental-Graph Type and Fundamental Ability Rating, Complex Mental Process Rating, Intellectual-Emotional Rating } ...+0.69

The correlated weight falls about equal upon the Complex Mental Process and Intellectual-Emotional rating and somewhat heavier upon the Fundamental Ability Rating.

A correlation with educational achievement was made with the Psychology course grades of the Summer School sessions. The grades were attained by the individuals in a three unit course in the fundamental backgrounds of Psychology, and had been secured through the combined contact and grading of five individuals. In this instance the Grade used was that given in the College record—*D*, *G*, *P*, *N* or *F*.

The correlation between the Psychology Grades and the various factors of the Mental-graph and the Multiple correlation follows:

r—Psychology Grades and Fundamental Abilities Rating..... +0.24
r—Psychology Grades and Complex Mental Processes Rating..... +0.18
r—Psychology Grades and Intellectual-Emotional Rating..... +0.36
r—Fundamental Abilities Rating and Complex Mental Processes Rating..... +0.41
r—Fundamental Abilities Rating and Intellectual-Emotional Rating..... +0.26
r—Complex Mental Processes Rating and Intellectual-Emotional Rating..... +0.36

R—Psychology Grades and Fundamental Abilities Rating, Complex Mental Processes Rating, Intellectual-Emotional Rating } +0.38

The correlation between the Grades and the Mental-graph Types follows:

r—Psychology Grades and Mental-Graph Types..... +0.54

The high correlation between the estimated Mental-graph Type and the Ratings secured through the sigma-massed scores indicates clearly that the Clinical Psychologist can estimate the Mental-graph Type only by keeping clearly in mind the value of the various tests of Fundamental Ability and Complex Mental Processes. A very significant fact is to be found in the high correlation between the Intellectual-Emotional Rating and the Grades; that some emotional element must be weighted in all measurements of General Scholastic Aptitude is clearly indicated by this as by former studies; and finally the evaluated Mental-graph, representing the common sense clinical diagnosis, has given the highest and most significant correlation with the Academic success.

The use of the Mental-graph in the College Personnel work has been of vital importance in the solution of case problems. By it the general ability of the individual has been discerned and the possibility presented of directing the individual in a greater use of the same. In the examination the specific abilities and defects may be noted—and a compensatory adjustment of the same uncovered. Several case problems are quoted as to the use of the present material.

Case 1. College Sophomore. Age 20

Referred by the Dean of the College for having been placed on General Probation due to failure in two courses comprising four units of work.

The College Office Record revealed that Student had made five attempts at Freshman first and second term work. Numerous actions under the Rules of Leave of Absence and Withdrawal had been used to his favor because of his physical condition. A thorough medical examination showed poor general health backgrounds with a tendency toward hypochondria.

His social backgrounds were of excellent quality.

Mental examination. Mental-Graph Type, Inferior, 15–20 percentile. The Apperceptive Processes were low in function. Informational Content, Inferior. Motor Control, deficient. Emotional Response, slightly

below Median and revealed a specific Expressive-Regressive Attitude mal-adjustment, which hampered the individual in his social adjustment.

General mental capacity revealed an inferior quality for College work. The individual is probably capable of a very poor quality of work at the Junior College level. Physical defects were largely responsible for the mal-adjustment of emotional response.

Under special treatment, the physical condition and resulting mal-adjustments did not clear up rapidly enough to enable the individual to succeed properly in his Academic work. The individual was, therefore, permitted to withdraw from College until such time as his condition had improved. It is highly problematic that the individual should again attempt College work.

Case 2. College Student Sophomore. Age 22

Student carrying Pre-Engineering course. Failed several courses fundamental to the Engineering training and referred voluntarily at the suggestion of an Instructor in one of the Pre-Engineering pre-requisite courses with problems of vocational interest and general adjustment.

Vocational interest was more or less fluctuating. Student had raised a very definite question in his own mind as to probable success in the same. The general problem of mal-adjustment had arisen from the home economic conditions.

Social backgrounds were of a Median-low type. The father had deserted the family, and the mother was supporting and educating three children. Student was carrying his course and earning as much as possible at the same time. Physical condition indicated definite problem of under-weight and low nervous energy.

Mental examination. Mental-Graph type, Inferior, 15–20 percentile. The Apperceptive Processes were slightly low. Informational content was low. Emotional response was Median. Basic problem; Expressive-Regressive Attitude and general emotional impulse deficiency.

General mental capacity for College thoroughly problematic for such technical training as the individual desired. His success would be obtained probably at the Junior College Level. The individual had a choice of an out-door camp activity, the farm, or a surveying squad for the Summer. The medical advice indicated the farm for general physical condition. Student was instructed in the methods by which he might evaluate his immediate vocational interest. He withdrew from College at end of year and was attempting to establish his interest in the practical mechanical field.

Case 3. Arts and Science Sophomore. Age 19

Carrying Pre-Engineering Course. Referred by the Dean of the College after having been placed on General Probation because of failure in two Pre-Engineering pre-requisite courses. Individual had rather skeptical attitude toward the whole Personnel procedure. Later co-operated heartily in conference.

Mental Examination. Mental-Graph type, Median, tricky type. The Fundamental Abilities range from 30–80 percentile and Complex Mental Processes 10–90 percentile. The apperceptive processes were rather low. Emotional response was good. Physical condition revealed a general lethargic background.

The general mental capacity was thoroughly problematic for advanced technical training and engineering. Such a tricky type is favorable only under most definite application and with the individual willing constantly to check his ability in use. The individual was referred to the Physical Education Department for toning up the general physical condition and adjustment. The student cleared his record at the end of the year, but recognizing the problem of his ability withdrew from College seeking to evaluate his vocational interest in the practical mechanical field.

Case 4. College Senior. Age 21

Referred by the Dean of the College after having been placed on General Probation, which had been continued from the previous year.

Social backgrounds of the individual were excellent. He had been over-indulged in the matter of luxurious clothing, expensive roadster and general luxuries. He had not applied himself to his College work.

Mental examination. Mental-Graph type, Median-High, 70 percentile plus. All mental factors of excellent quality and emotional response quite good.

Student had more than ample capacity to carry College work; in fact superior capacity for the same. However, a slight laziness and over-indulgence brought him into bad habits of indifference. He had become over-cut in classes due to lack of coöperation and had been dropped from the rolls of two classes. During the Spring term student's father for the first time became cognizant of the position and became rather disgusted with his attitude. Student was desirous by this time of completing his work and entering the Law School in the Fall. It is quite apparent that the individual had chosen his roster with rather keen discrimination for the courses in which he would be able to play his own game. It would appear to a large degree that his actual ability had at no time been challenged, his Academic record becoming extremely involved and he was dropped from the rolls of the College.

The present indications are that the individual will meet the adjustment of his condition and return to complete his College course with an entirely different purpose and attitude and go on to a successful completion of his professional training.

Case 5. College Senior. Age 22

Referred on disciplinary problem involving expulsion from class room. Individual combative and nasty in personal response both individually and socially. His emotional response deficiency was due to a definite physiological mal-adjustment.

Mental examination. Mental-Graph type, Superior. One of the most brilliant men of College Adult Level by reputation and by examination.

The entire problem resolved itself into a mal-adjustment of emotional response. The mental capacity of the individual was not only hampered, but perverted by the mal-adjustment. A thorough physical examination revealed specific systemic, physiological and neurological conditions requiring treatment for an extended period of time. Individual and social response adjustments were also tedious, requiring participation in sport activities and social functions. A six-month period revealed a marked improvement. At the end of a year the individual completed his College course and proceeded to professional training. The eight individuals who coöperated in the adjustment program were unanimous in the opinion that a highly superior mental equipment has been saved from a vicious perversion to an excellent social usefulness.

COLLEGE ADULT LEVEL STANDARDS FOR THE MENTAL-GRAPH

The Mental-Graph Type should be based upon a well standardized percentile distribution. It is not necessary to construct the Mental-Graph on the same materials used in the studies presented. However, tests should be chosen after experimental study with an aim to balance composition of both Fundamental Abilities and Complex Mental Processes. Several College Adult Level standards in the score percentile form are presented to assist one in the construction of Mental-Graph. Other standards are being sought in large varieties of tests. The tests presented are those which have stood a large measure of practical use. They have been standardized on approximately four hundred to two thousand cases as indicated. There is a great variation in the content, constitution, method of

procedure, and quantitative scoring of these test materials. The standard for these factors will be noted in the original presentation of the test. In each instance the particular qualitative analysis of the processes involved is of vital significance. A brief analysis of each test has, therefore, been presented to indicate something of the abilities and processes involved. References are also given of the original presentation and of their employment at the College Adult Level.

Memory Span Test for Digits

Voco-auditory, graphic. 2070 cases

	Percentile		*Percentile*
12 —	100	8 —	56.6
11 —	97	7 —	33.1
10 —	90.1	6 —	14.1
9 —	79	5 — 4 —	3.3

Analysis. Memory Span is the ability to grasp a given number of discrete elements in a given moment of attention and to reproduce the same. It is the basis for the coherent associability of all mental function.

References:

R. A. Brotemarkle. Some Memory Span Problems. An Analytical Study at the College Adult Level. Psych. Clinic, 1924, 15, 229–258.

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Memory Span Test for Syllables

Voco-auditory, graphic. 1383 cases

	Percentile		*Percentile*
50 —	100	30 —	82.3
45 —	99.1	25 —	18.5
40 —	99	10 — 20 —	6.5
35	96.7		

Analysis. A slightly integrated form of associability dependent upon the coherency of the material.

References:

R. A. Brotemarkle. Some Memory Span Problems. An Analytical Study at the College Adult Level. Psych. Clinic, 1924, 15, 229–258.

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Memory Span Test for Ideas

Voco-auditory, graphic. 1293 cases

	Percentile		*Percentile*
9 — 12 —	100	4 —	48.9
8 —	93.5	3 —	33.1
7 —	87.3	2 —	20.6
6 —	78	0 — 1	7.9
5 —	64.3		

Analysis. A highly integrated form of associability dependent upon the coherency of the mental or ideational concept.

References:

R. A. Brotemarkle. Some Memory Span Problems. An Analytical Study at the College Adult Level. Psych. Clinic, 1924, 15, 229–258.

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Taylor Number Test

Visual, graphic. 730 cases

	Percentile		*Percentile*
20 — 28 —	100	13 —	52.3
19 —	95	12 —	41.3
18 —	92	11 —	28.7
17 —	87.3	10 —	13.2
16 —	73.8	9 —	8.3
15 —	70.8	3 — 8 —	5
14 —	59.1		

Analysis. A measure of the spread of distribution of attention, viewed as a mental factor, and the speed of exploration, viewed as a performance or physical factor.

Reference:

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Trabue Language Scale

J and K Combined. Visual, graphic. 240 Cases

	Percentile		*Percentile*
26 —	100	20 —	55
25 —	97	19 —	45
24 —	92	18 —	35
23 —	85	17 — 16 —	25
22 —	75	15 — 9 —	10
21 —	65		

Analysis. A general measure of the use of language symbols to express reasonable common-sense ideas or concepts. The analysis may include the factors of grammar, rhetoric, ideation, etc.

References:

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Marion Rex Trabue. Completion Test Language Scales. Columbia University, Teacher's College Contributions of Education, Vol. 77.

Roback Opposites Test

Visual, graphic. 459 cases

	Percentile		*Percentile*
82 —	100	48 —	40
80 —	99	46 —	36
78 —	99	44 —	30
74 —	98	42 —	25
72 —	97	40 —	20
70 —	96	38 —	16
68 —	94	36 —	13
66 —	92	34 —	9
64 —	88	32 —	6
62 —	85	30 —	5
60 —	80	28 —	4
58 —	73	26 —	3
56 —	67	24 —	2
54 —	59	22 —	1
52 —	52	20 —	0.5
50 —	47		

Analysis. A measure of the individual ability to discriminate and contrast ideational concepts; and the ability to recall the commonly accepted word to express the same.

Reference:

A. A. Roback. Mentality Test for Superior Adults. Tests and Manuals. C. A. Stoelting Company, Chicago.

Roback Judgment Test

Visual, graphic. 397 cases

	Percentile		*Percentile*
79 — 88 —	100	63 — —	51
78 — —	95	62 — —	46
74 — 77 —	90	61 — —	43
73 — —	85	60 — —	41
72 — —	80	59 — —	36
71 — —	75	57 — —	30
70 — —	71	54 — 56 —	25
68 — —	66	52 — 53 —	20
67 — —	62	49 — 51 —	15
66 — —	58	44 — 48 —	10
65 — —	57	34 — 43 —	5
64 — —	51	33 — —	1

Analysis. The ability to make controlled judgments involving understanding of meaningful concepts.

Reference:

A. A. Roback. Mentality Test for Superior Adults. Tests and Manuals. C. A. Stoelting Company, Chicago.

Roback Abstraction Test

Visual, graphic. 462 cases

	Percentile		*Percentile*
76 — 85 —	100	41 — —	45
69 — 75 —	95	40 — —	40
67 — 68 —	90	39 — —	37
63 — 66 —	85	38 — —	33
59 — 62 —	80	37 — —	30
54 — 58 —	75	35 — 36 —	25
50 — 53 —	70	33 — 34 —	20
48 — 49 —	65	31 — 32 —	15
46 — 47 —	60	27 — 30 —	10
44 — 45 —	55	17 — 26 —	5
42 — 43 —	50		

Analysis. The ability to discriminate between the trivial and essential; and to discern the basic concept fundamental to several ideas.

Reference:

A. A. Roback. Mentality Test for Superior Adults. Tests and Manuals. C. A. Stoelting Company, Chicago.

ROBACK REFERENCE TEST

Visual, graphic. 376 Cases

	Percentile		*Percentile*
43 — 53 —	100	31 — —	54
40 — 42 —	95	30 — —	45
39 — —	90	29 — —	40
38 — —	86	28 — —	35
37 — —	85	27 — —	30
36 — —	80	26 — —	23
35 — —	77	25 — —	14
34 — —	72	22 — 24 —	10
33 — —	65	17 — 21 —	5
32 — —	60		

Analysis. The ability to store a highly integrated mass of associated ideas, and to recall many of them through the stimulus of the essential concept.

Reference:

A. A. Roback. Mentality Test for Superior Adults. Tests and Manuals. C. A. Stoelting Company, Chicago.

ROBACK APPLICATION TEST

Visual, graphic. 432 cases

	Percentile		*Percentile*
73 — 93 —	100	43 — —	50
70 — —	95	40 — —	40
67 — —	90	37 — —	31
63 — —	85	33 — —	24
60 — —	80	30 — —	17
57 — —	75	27 — —	11
53 — —	70	20 — 23 —	10
50 — —	65	13 — 17 —	5
47 — —	56	7 — —	2

Analysis. The ability to discern and understand the common-sense meaning of integrated ideas; and the recall of experiences in life which express the essential concept involved.

References:

A. A. Roback. Mentality Test for Superior Adults. Tests and Manuals. C. A. Stoelting Company, Chicago.

A. A. Roback. Comprehension Test. Revised form. Tests and Manual. C. A. Stoelting Company, Chicago.

Judge Baker Foundation Scaled Information Test

Visual, graphic. 430 cases

	Percentile		*Percentile*
25 — —	100	21 — —	17.6
24 — —	83.4	20 — —	7.6
23 — —	56.1	18 — 19 —	3
22 — —	35.2		

Analysis. The measure of the retention of every-day experience of many forms; the ability to amass a reasonable stock of common information.

Reference:

A Manual of Individual Mental Tests and Testing. Judge Baker Foundation Pub. No. 4. Judge Baker Foundation, Boston, Mass.

Courtis Arithmetic Test

Visual, graphic. 400 cases

	Percentile		*Percentile*
19— — —	100	12 — —	63
18 — —	98	11.5 — —	54
17 — —	97	11 — —	52
16.5 — —	93	10.5 — —	41
16 — —	92	10 — —	40
15.5 — —	89	9.5 — —	32
15 — —	88	9 — —	30
14.5 — —	82	8.5 — —	23
14 — —	81	7.5 — 8 —	20
13.5 — —	74	7 — —	12
13 — —	72	5.5 — 6.5 —	6
12.5 — —	64	3 — 5 —	3

Analysis. A measure of the ability to use the fundamental operations in arithmetic procedure.

Reference:

S. A. Courtis. School Practice Tests in Arithmetic, Vols. 1, 2, 3. Tests and Manuals. World Book Company.

Brotemarkle Comparison Test

Visual, graphic. 915 cases

	Percentile		*Percentile*
8 — 12 —	100	26 — —	40.9
14 — —	92.8	28 — —	34
16 — —	88.8	30 — —	26.8
18 — —	78.1	32 — —	20.4
20 — —	70.7	34 — —	15.5
22 — —	60.1	36 — 40 —	11.3
24 — —	53.8	42 — 68 —	4.5

Analysis. A measure of deviation from the normal ideational content of moral concepts. Certain factors of the emotional response may be analyzed from each test involved.

Reference:

R. A. Brotemarkle. Comparison Test for investigating the Ideational Content of Moral Concepts. J. Appl. Psychl., 1922, 6, 235–242.

Healy-Bronner Learning Z

Visual, graphic. 403 cases

	Percentile		*Percentile*
53 — 54 —	100	41 — —	47
51 — 52 —	95	39 — 40 —	42
50 — —	90	37 — 38 —	34
49 — —	86	36 — —	30
48 — —	81	34 — 35 —	26
47 — —	75	32 — 33 —	20
46 — —	70	30 — 31 —	15
45 — —	64	25 — 29 —	10
44 — —	60	23 — 24 —	5
43 — —	54	12 — 22 —	3
42 — —	51		

Analysis. A measure of the learning capacity; the ability to learn and the type of accuracy and speed of learning.

Reference:

A Manual of Individual Mental Tests and Testing. Judge Baker Foundation Pub. No. 4. Judge Baker Foundation, Boston, Mass.

Ferguson Form Boards

College adult level. Visual, motor. 431 cases

Board 4		Board 5		Board 6	
Per cent	Seconds	Per cent	Seconds	Per cent	Seconds
100	27	100	40	100	42
	48		66		84
90	49	90	67	90	85
	59		79		113
80	60	80	80	80	115
	68		91		141
70	69	70	92	70	142
	79		106		172
60	80	60	107	60	173
	87		120		200
50	88	50	121	50	201
	96		137		237
40	97	40	138	40	238
	113		162		295
30	114	30	163	30	296
	137		193		F
20	138	20	194	20	F
	193		248		F
10	194	10	249	10	F
	F		F		F

Averaged percentage score	*Percentile for Ferguson Boards 4, 5 and 6. 431 Cases*	*Averaged percentage score*	*Percentile for Ferguson Boards 4, 5 and 6. 431 Cases*
100	100	56.6	55
96.6	99	53.3	47
93.3	98	50	43
90	96	46.6	38
86.6	92	43.3	32
83.3	90	40	27
80	86	36.6	21
76.6	83	33.3	17
73.3	80	30	14
70	77	26.6	10
66.6	71	23.3	6
63.3	67	20	3
60	62	16.6	2

Analysis. The ability to solve what for the individual is a new problem, in increasing complexity and difficulty. The performance lends itself to analysis in terms of physical, mental and emotional reactions. The coördination, control and physical vivacity may be noted. The spread or distribution of attention, the discrimination of form, size and shape, and the understanding of relationships involved may be discerned. The mental alertness, the planfulness and resourcefulness may be noted. The nervous stability, innervation and objective and subjective emotivity may be discerned. All other factors discernible to the eye of the clinician are revealed in greater or lesser intensity.

Reference:

George Oscar Ferguson, Jr. J., Exper. Psychl., III, 1, 1920.

Witmer Cylinders Test

College adult level. Visual, motor. 406 cases

Seconds	*Percentile*	*Seconds*	*Percentile*
18–34	100	54–60	40
35–37	90	61–72	30
38–40	80	73–97	20
41–43	70	98–179	10
44–48	60		
49–53	50	F(180)	2.5

Analysis. A single performance problem amenable to the analysis for which all performance materials are adapted, of great importance because of its arrangement, which lends itself readily to rapidly

unfolding discrimination and transfer of learning. An excellent trainability measure in the case of several repetitions.

References:

Karl G. Miller. Competency of Fifty College Students. University of Pennsylvania Experimental Studies in Psych. and Ped., 1922, No. 8; Psych. Clinic, 1922, 14, 1–25.

Franklin C. Paschal. The Witmer Cylinder Test. The Hershey Company, Hershey, Pa., 1919

SOME PSYCHOLOGICAL ASPECTS OF COMMITTEE WORK[1]

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INTRODUCTION

Today a large part of the world's work is carried on by committees. It is seldom feasible for an entire democratic group to consider and decide every issue; hence the selection of smaller and more wieldy groups to consider details and even make final decisions for the larger group which they represent. This trend is well illustrated in national government, in industry and in academic circles.

What do we find these committees doing? Their tasks run the whole gamut from the simple to the complex; from the concrete to the abstract; from the trivial to the profound. How do we find these groups doing their work? In a great many ways. Some have a definite plan of procedure while others work more or less at random. Some committee meetings are formal others very informal. Studies to date shed only a dim light on committee efficiency. This is an age of efficiency yet the technique of efficiency procedure has not been adapted to the problem of committee procedure.

There are a great many problems involved but the writer has selected the following four typical phases:

1. What is the best size for a committee?
2. How is the sex factor related to committee efficiency?
3. Should the committee have a definite amount of time in which to act or should there be no time limit?

[1] The first installment of this article was published in the October, 1927, issue of the JOURNAL.

4. Are there certain types of individuals who can work more effectively on one kind of committee problem than on another?

MATERIAL AND METHOD

In selecting the material for this experiment an effort was made to select problems similar to those which the committee would have to solve in practical life. Consequently several types of material were selected, ranging from the concrete to the more abstract. While the effects of practice with these materials subsequently proved to be only slight still whenever it was technically possible a practice series was used in order to get the subjects acquainted with the type of experiment to be performed. In most cases the material was divided into two series, Series I and Series II, which were of approximately equal difficulty. This was done by preliminary experiments where the actual time for each photograph or problem was recorded. In arranging the two series care was taken to divide the photographs or problems into series so that the total time for each series would be practically the same. Thus the practice effect could be determined by comparing the performances on the two series.

The results were scored in two ways,—first, on the basis of the accuracy of the performance and second, on the time required to complete the experiment. In practical life we are concerned both with the rapidity of the committee's action and the quality of its report. Four types of material were used:

1. Photographs Portraying Emotions
2. Multiple Choice Problems
3. Bridge Problems
4. Grading English Compositions

Investigators have long been interested in facial expression as related to emotions. Although it is highly improbable that permanent mental characteristics such as intelligence, neatness, sociability, etc., may be judged with accuracy from facial contours and expressions, it would seem that such

temporary conditions as emotions which involve definite movements of muscles may be so judged. This material was selected because it yields a rather personal type of situation. The photographs used in this experiment were the same as those used by Feleky (1). These photographs were placed in random order on the table before the group and the subjects were required to select pictures which portrayed certain emotions as specified on a mimeographed list which had been given to them.

The Multiple Choice apparatus and the problems used were similar to those used by Yerkes (2).

The Bridge Problems were similar to those found in Work's (3) book on Auction Bridge.

The English Compositions were selected from those used by Thorndike (4).

There were 1312 subjects used in this experiment. Over 50 per cent of the group were of Freshmen or Sophomore rank. Their ages ranged from fifteen to thirty years with a median age of twenty. The group of subjects ranked higher in intelligence than an average group.

In a recent number of this JOURNAL the writer (5) discussed the influence of the size of a committee upon its efficiency. The following conclusions were drawn.

SIZE OF COMMITTEE

I. The size of a committee has much to do with its efficiency. The difference in performance according to size depends somewhat on the type of problem which the group has to perform. The smaller groups are more efficient on the personal type of problem,—the Photographs Portraying Emotions and the Judging of English Compositions. In this type of problem each individual forms his own personal opinion at the outset and when the groups are small there are fewer such personal opinions to be reconciled than when the group is large. In the case of the Multiple Choice Problems and the Bridge Problems, two examples of abstract and impersonal kinds of material, the larger groups are better. In these

types of problem no one comes with a preconceived idea, but each member contributes then and there to the solution. The many ideas or suggestions contributed by the members of large groups seem to aid in the solution of the abstract problem but to slow up the progress on the personal type of problem.

II. The size factor is still further influenced by sex. On the abstract material the larger groups of females are better while on the concrete there is not so much difference. The larger female groups profit more by mutual interstimulation.

Let us now consider the other phases of the problem namely, sex, effect of a time limit, and the types of persons who serve on committees.

SEX OF COMMITTEES

Should committees be composed of members of the same sex only? Is there any relation between sex and the type of work the committee can perform most effectively? Other studies have shown slight sex differences in efficiency but have suggested larger differences in attitude and interest. It seemed possible that such differences might be discovered in the present experiment.

The four types of material mentioned above were used in this experiment on sex. There were 322 males and 281 females who served as subjects in the experiment. In most instances groups of 4 males, 4 females, or mixed groups consisting of 2 males and 2 females participated. In a few cases groups of 3 members and groups of 6 members each were used. The results are found in table 1. In the case of the groups working on all 24 of the photographs as a single series the male groups are quicker but less accurate than the female groups. The mixed committee is quicker than the male or female groups and its accuracy is only slightly better than the males. This would suggest that if we are interested more in accuracy than in speed mixed groups are not quite so desirable as groups of one sex.

It was possible to get other data on the question of sex by making comparison of male, female and mixed groups when

TABLE 1*

Photographs Portraying Emotions

	MALE		FEMALE		MIXED	
	Time	Number correct	Time	Number correct	Time	Number correct
Groups of 4 members using all 24 photographs						
	seconds 1,335	11	*seconds* 1,469	17	*seconds* 1,230	13
Groups of 4 members working "ad lib"						
Series I	190	9	229	8	180	8
Series II	223	7	322	8	273	10
Average	206	8	275	8	226	9
Groups of 4 members working with a time limit						
Series I	141	8	124	7	121	8
Series II	112	8	184	7	127	8
Average	126	8	154	7	124	8
Groups of 3 members working "ad lib"						
Series I	147	9	180	8		
Series II	203	9	134	8		
Average	175	9	157	8		
Groups of 6 members working "ad lib"						
Series I	195	9	217	7		
Series II	159	7	197	7		
Average	177	8	207	7		

* All figures quoted in tables are averages of group performances taken from larger tables in original experiment.

they were given all the time they wanted to solve a series of the photographs and also when a definite time limit was placed on their actions. Results for such groups working with both Series I and Series II are shown in table 1.

When we compare the groups working "ad lib," we find the males take 206 seconds with 8 photographs correct, the females 275 seconds with 8 correct, the mixed 226 seconds with 9 correct. In the above data with no time limit the results favor the males on speed and the mixed groups on accuracy. However the males are only slightly less accurate and a little quicker.

The results for similar groups on both series when a definite time limit has been announced show that the females average 154 seconds with 7 correct, the males average 127 seconds with 8 correct, and the mixed average 124 seconds with 8 correct. These results show the male groups are 12 per cent quicker than the female and mixed groups are 1 per cent quicker than the male and 19 per cent quicker than female. There is very little difference in accuracy. However the mixed groups are as accurate as the males and 12 per cent more accurate than the females. The mixed groups seem to be the most efficient. Since the practice effect with this type of material was only 9 per cent in time and 2 per cent in accuracy, it does not play an important rôle here and the time limit is the real causal factor.

Results for groups of 3 members are shown in the next section of table 1. Considering results of Series I and Series II together the groups of 3 males take on the average 175 seconds and get 9 photographs correct while the groups of 3 females take 157 seconds with 8 photographs correct. Comparing male and female groups of 3 members each indicates that the males are slightly more accurate than the females, the latter being a little quicker. This may be due somewhat to the fact that this type of material may be easier for the females than the males because of its being more personal and closer to their own experience and interests.

When we examine the results for the groups of six members

each as shown in the table we find that when we combine results for Series I and II the male groups of 6 members take on the average 177 seconds and get 8 photographs correct while the females average 207 seconds with an accuracy of 7. The small female groups are slightly superior to the male groups and the large female groups are inferior to the large male groups in their performance on this type of material. This latter tendency was also noted in our discussion of size of committees. In that case we found that the larger groups were inferior in judging the photographs and that this trend was greater in the case of females than males.

Let us consider the sex variable using the second kind of material, viz., the Multiple Choice Problems. The results are shown in table 2. In experimenting with some of the groups the entire 8 problems were used as one series. The groups of 4 males on an average use 599 seconds and 86 keys in solving the eight problems, the groups of 4 females 466 seconds and 98 keys, and the mixed groups 655 seconds and 106 keys. Considering the average results for these three types of groups the males are more accurate and slower than the females, who take more keys and less time, suggesting that the females react more quickly to the situation and profit less by their pressing the wrong key. This probably causes the marked difference in results when we look at the averages for the mixed groups. In this case the mixed group takes both more keys and more time. It seemed to the writer in his observation of the groups that the Multiple Choice problems were more difficult for the female than for the male. This may be because of their abstractness and therefore women are not so much interested in them. The Photographs present a different type of situation.

It was possible to get other data on the question of sex by making comparison of male, female and mixed groups when they were given all the time they wanted to solve a series of Multiple Choice Problems and also when a definite time limit was placed upon their actions. These results are shown in the second and third sections of the table. When the results

TABLE 2

Multiple Choice Problem

	MALE		FEMALE		MIXED	
	Time	Number of keys	Time	Number of keys	Time	Number of keys
Groups of 4 members using all 8 problems						
	seconds 599	86	*seconds* 466	98	*seconds* 655	106
Groups of 4 members working "ad lib"						
Series I	166	36	251	42	272	46
Series II	255	40	179	30	269	38
Average	210	38	215	36	270	42
Groups of 4 members working with a time limit						
Series I	181	32	61	25	177	32
Series II	185	46	132	31	231	50
Average	183	39	96	28	204	41
Groups of 3 members "ad lib"						
Series I	172	40	220	44		
Series II	200	45	231	55		
Average	186	43	225	49		
Groups of 6 members "ad lib"						
Series I	154	47	124	37		
Series II	162	57	227	47		
Average	158	52	175	42		

of both series are combined the males use 211 seconds and 38 keys, the females 259 seconds and 36 keys, and the mixed

groups 271 seconds and 42 keys. In the final analysis the males are quickest and are only slightly inferior in accuracy when compared with the females. The mixed groups are slower and less accurate than the others. These results corroborate the preceding results.

When we consider the results of similar groups when a definite time limit has been announced we find in combining the results of the two series that the male groups use 183 seconds and 39 keys, the females 96 seconds and 28 keys, the mixed groups 204 seconds and 41 keys. In this case also the females are quicker and more accurate. The mixed groups are not so efficient as in the "ad lib" results. The effect of practice in this type of material is only slight. The groups with practice do 16 per cent better but do not gain in accuracy. However, the practice effect was taken care of by the arrangement of groups as previously suggested so that it does not affect the results as just presented.

It was also possible to get data on groups composed of 3 members each and of 6 members each, using the two series of Multiple Choice Problems. These results are shown in the last two sections of table 2. When we group together Series I and Series II the groups of 3 males average 186 seconds and 43 keys while the groups of 3 females use 225 seconds and 49 keys. We can conclude that the female groups of this size are slightly inferior. In the case of the larger groups the males average 158 seconds and 52 keys, the females 175 seconds and 42 keys. These results indicate that the female groups of this size are 19 per cent more accurate than the male groups, but are 9 per cent slower. In summarizing the results on this type of material we may say that there is a rather marked sex difference. We should also consider that the size variable seems to be a factor. The type of material likewise has something to do with efficiency of the committee. These results show that the concrete and personal types of problem are solved more readily by females and that abstract and impersonal types are more easily solved by the males. The interests of the group and the way in which they attack the

problem must not be overlooked. It suggests the distinction that is sometimes made in the literature on sex differences

TABLE 3
Bridge Problems

	TIME		
	Male	Female	Mixed
Groups of 4 members working "ad lib"			
	seconds	*seconds*	*seconds*
Series I	924	863	1,099
Series II	924	783	138
Average	924	823	618
Groups of 4 members working with a time limit			
Series I	1,009	834	493
Series II	489	182	471
Average	749	458	482
Groups of 3 members working "ad lib"			
Series I	830	817	
Series II	659	792	
Average	744	754	
Groups of 6 members working "ad lib"			
Series I	426	1,385	
Series II	528	510	
Average	477	927	

between the interests of the two sexes,—the females taking greater interest in personal matters and the males in abstract.

The results for the third kind of material, Bridge Problems,

are shown in table 3. The first section gives the results for groups of 3 members each working without a time limit. When we average the results for these groups on both series the average for the males is 924 seconds, the females 823 seconds and the mixed groups 618 seconds. In this case the difference in behavior due to sex is fairly well marked. It would seem that mixed groups are more efficient than those of one sex.

The results of similar groups working under a time limit show that the males are the slowest of the three groups on both series. The female groups are slower on Series I than on Series II but when their results for both series are averaged they are faster than the males. The mixed groups are quicker than the male groups and only a little slower than the female groups. This bears out the conclusion from the previous tables in which were given findings for groups not working under a time limit.

Further data were collected on the question of sex using male and female groups of 3 members and of 6 members. In the case of the smaller groups working "ad lib" when the results of both Series I and Series II are combined the results favor the male groups with an average of 744 seconds against the female groups with an average of 754 seconds. For similar groups of 6 members each the males average 477 seconds, the females 947 seconds. The females take more time than the males and this tendency is more marked in the groups of 6 than in groups of 3.

If we disregard series, size of group, and time limit and compare male versus female groups we find the male groups average 705 seconds, the female groups 816 seconds. The male groups are 13 per cent more efficient than the females in solving such problems.

These results show that the male groups tend to be quicker in each case. When compared with female and mixed groups they are 14 per cent better. They are superior in groups of 3 and the only situation in which they seem at all inferior is in groups of 6 members.

Results for the Judgments of English Composition, the

fourth type of material used, are shown in table 4. Combining results of both series we find that in the case of the groups

TABLE 4

Judging English Compositions

	MALE		FEMALE		MIXED	
	Time	Accuracy	Time	Accuracy	Time	Accuracy
Groups of 4 members working "ad lib"						
	seconds		*seconds*		*seconds*	
Series I	1,141	0.62	967	0.69	1,130	0.56
Series II	1,113	0.70	831	0.65	1,154	0.69
Average	1,127	0.66	899	0.67	1,142	0.62
Groups of 4 members working with a time limit						
Series I	716	0.49	396	0.39	826	0.75
Series II	709	0.79	559	0.76	688	0.72
Average	712	0.64	477	0.57	757	0.73
Groups of 3 members working "ad lib"						
Series I	1,063	0.32	826	0.49		
Series II	688	0.61	625	0.59		
Average	875	0.46	725	0.54		
Groups of 6 members working "ad lib"						
Series I	1,718	0.64	1,361	0.4		
Series II	1,206	0.83	864	0.7		
Average	1,462	0.73	1,112	0.5		

of 4 members each working "ad lib" the male groups average 1127 seconds with 0.66, the female groups 899 seconds with 0.67, and the mixed 1142 seconds with 0.62. The female

groups are more accurate and quicker while the mixed groups are slower than either males and females and are the least accurate. It was possible to get data on similar groups with a definite time limit. In this case when Series I and Series II are combined we find the males have 712 seconds with an accuracy of 0.64, the females 477 seconds and 0.57, the mixed 752 seconds and 0.73. The females are the quickest and the least accurate while the mixed groups are slower and more accurate.

It was also possible to compare males and females in groups of 3 and groups of 6 members each (see table 4). In the case of the smaller groups when we average the results for both series the male groups average 875 seconds and 0.46, the female 725 seconds and 0.54. In both series as well as when the results are grouped the trend in both accuracy and speed is in favor of the female groups.

In groups of 6 members each the males use 1462 seconds and average 0.73 in accuracy; the female groups take 1112 seconds and 0.5 for accuracy. These results for groups of 6 agree with those for groups of 3 in speed but not to an equal degree in accuracy. Again it seems that the smaller groups are more accurate.

THE EFFECT OF TIME LIMIT ON COMMITTEE EFFICIENCY

Should a committee have a definite amount of time in which to solve its problem or should it operate without a time limit? Is it possible to speed up the actions of a group without seriously impairing its efficiency? The present section discusses experimental results dealing with these problems.

The same four types of materials, viz., Photographs Portraying Emotions, Multiple Choice Problems, Bridge Problems and English Compositions were used in this experiment. It was always necessary to use both Series I and Series II of the material. For instance, Series I would be given "ad lib," i.e., with no suggestion of a time limit, followed by Series II with a definite announced time limit, e.g., "You have 10 minutes in which to make these selections." The above order

was reversed for some groups, Series II being given "ad lib" followed by Series I with a time limit. It was necessary to have the "ad lib" series first for otherwise the first time limit series would give a set that would vitiate the subsequent "ad lib." The time limit used in each type of material was determined by preliminary experiments with several groups of subjects. The time selected for the subsequent experiments was a little less than the average time required by the preliminary groups.

In all cases three types of groups were used (*a*) groups of 4 males, (*b*) groups of 4 females and (*c*) groups consisting of 2 males and 2 females. In this section 136 males and 124 females were used. The results are shown in table 5.

The average time for the males on Series I "ad lib" is 190 seconds with 9 photographs correct, and on Series II with a time limit, the average is 112 seconds with an accuracy of 8. The female groups on Series I "ad lib" average 229 seconds with 8 photographs correct, and on Series II with a time limit, 184 seconds with 7 photographs correct. The mixed groups on Series I "ad lib" take 180 seconds and get 8 photographs correct while on Series II with definite time limit they require 127 seconds and get 9 photographs correct.

If we pool the results disregarding sex and consider all groups together, the groups on Series I "ad lib" take on the average 199 seconds with an accuracy of 8; while on Series II with a time limit they take 141 seconds with an accuracy of 8. They are thus about 30 per cent quicker and show no appreciable decrease in accuracy.

Now let us consider the results where the groups do Series II "ad lib" and Series I with a 5-minute time limit. These are shown in the second half of table 5. The male groups on Series II "ad lib" take 216 seconds and get 7 photographs correct and on Series I with time limit 144 seconds and get 8 photographs correct. The female groups on Series II "ad lib" take 322 seconds with 8 photographs correct while on Series I with time limit 124 seconds and get 7 photographs correct. The mixed groups on Series II "ad lib" average 273

seconds with an accuracy of 10 and on Series I with a time limit 121 seconds and 8 photographs correct. Considering all groups who performed these series in this order the average for the "ad lib" series is 270 seconds with 8 photographs correct while with the time limit the average is 129 seconds with an accuracy of 8. The two orders of the series corroborate one another in the superiority of the time limit method.

TABLE 5

Photographs Portraying Emotions

	SERIES I. "AD LIB"		SERIES II. TIME LIMIT	
	Time	Accuracy	Time	Accuracy
	seconds		*seconds*	
Male groups	190	9	112	8
Female groups	229	8	184	7
Mixed groups	180	8	127	9
Average	199	8	141	8
	SERIES II. "AD LIB"		SERIES I. TIME LIMIT	
Male groups	216	7	144	8
Female groups	322	8	124	7
Mixed groups	273	10	121	8
Average	270	8	129	7

When we disregard Series I and II of material and consider all the male groups we find the average on the "ad lib" to be 203 seconds with 8 correct; and on the time limit 128 seconds with 8 correct. The female groups average 275 seconds and get 8 correct working on the "ad lib" while with the time limit they average 154 seconds and get 7 correct. Here the time used is less and there is no appreciable decrease in efficiency. The mixed groups working "ad lib" average 226 seconds with an accuracy of 9 and under a time limit 124 seconds with 8 correct. These results are similar to those above.

Finally, if we consider all the groups working "ad lib" they take 235 seconds and get 8 photographs correct. Under time limit they take 135 seconds and get 8 photographs correct. In general with this material the groups work much faster under "fire" and without any decrease in efficiency. On the average they save about 42 per cent of the time. The females do not seem relatively quite so efficient under time limit as the males; however, the two change consistently in the same direction.

We find that the practice effect for photographs is 9 per cent in speed and 2 per cent in accuracy so if we subtract this 9 per cent from the foregoing time percentages we have a residue of 21 per cent for the women and 29 per cent for the men that can be attributed to the time limit instructions.

Let us now examine the results with the Multiple Choice Problems. The general plan of procedure was identical with that previously described and the same types of groups were used. These results are recorded in table 6. The males doing Series I "ad lib" average 166 seconds and 36 keys while doing Series II with a time limit they average 185 seconds and 46 keys. The female groups working in the same order use 251 seconds and 42 keys on Series I and 132 seconds and 31 keys on Series II. The mixed groups use 272 seconds and 46 keys on Series I while on Series II they use 231 seconds and 50 keys. The males with a time limit take more time and are less accurate, the females take less time and are more accurate while the mixed groups take slightly less time and are a little more accurate. This is one of the few cases when the "ad lib" group is superior to the time limit group. It probably represents a chance variation from the general trend. The trend shows best in the case of the females. When all the groups, male, female and mixed are considered together on Series I "ad lib" they average 229 seconds and 41 keys while when timed they use 182 seconds and 42 keys. These results favor the time limit. The limited groups are 20 per cent quicker and only slightly less accurate.

When we consider the groups doing Series II "ad lib" fol-

lowed by Series I timed the male groups require 255 seconds and 40 keys on Series II with 181 seconds and 32 keys on Series I; the females 179 seconds and 30 keys on Series II and 40 seconds and 17 keys on Series I; the mixed groups 264 seconds and 37 keys on the "ad lib" series and 148 seconds and 30 keys on the time limited series. This shows that all these groups are consistently superior in the timed series both from the standpoint of speed and accuracy.

TABLE 6

Multiple Choice Problems

	SERIES I. "AD LIB"		SERIES II. TIME LIMIT	
	Time	Accuracy	Time	Accuracy
	seconds		*seconds*	
Male groups	166	36	185	46
Female groups	251	42	132	31
Mixed groups	272	46	231	50
Average	229	41	182	42
	SERIES II. "AD LIB"		SERIES I. TIME LIMIT	
Male groups	255	40	181	32
Female groups	179	30	40	17
Mixed groups	264	37	148	30
Average	232	32	123	26

Let us see what happens when we consider the results of all groups working "ad lib" versus those with time limit. All the male groups on "ad lib" average 210 seconds and 38 keys. When they do problems with a time limit they average 183 seconds and 39 keys. The females average 215 seconds and 36 keys on the "ad lib" and 86 seconds and 24 keys when working under a time limit. The mixed groups average 268 seconds and 41 keys on "ad lib" series and 189 seconds and 40 keys on times series. Thus all these groups under a time limit work

much faster and there is only a slight decrease in efficiency which seems a little more marked in the male groups.

Finally considering all the groups together they average 293 seconds and 38 keys when they work "ad lib" and 152 seconds and 32 keys when they are timed. This shows an increase of 15 per cent in accuracy and an increase of 48 per cent in speed in favor of the group working under a time limit. The

TABLE 7

Bridge Problems

	TIME	
	Series I. "ad lib"	Series II. Time limit
	seconds	*seconds*
Male groups	924	489
Female groups	1,063	182
Mixed groups	1,099	471
Average	1,028	380
	Series II. "ad lib"	Series I. Time limit
Male groups	1,120	1,009
Female groups	783	834
Mixed groups	694	493
Average	865	788

practice effect with this material is 16 per cent leaving a 32 per cent increase in efficiency due to the time limit.

In the case of the Bridge Problems the general plan of procedure was the same as that which has been given for other problems. These results are given in table 7.

The male groups average 924 seconds on Series I "ad lib" and 489 seconds on Series II with a time limit; the female groups average 1063 seconds on the former and 182 seconds on the latter; the mixed 1099 seconds on the first and 471 seconds

on the second. Combining all three kinds of groups, the average on Series I "ad lib" is 1028 seconds and on Series II with a time limit is 380 seconds showing over 63 per cent increase in efficiency as measured by speed.

The male groups average 1120 seconds on Series II "ad lib" and 1009 seconds on Series I with a time limit. The female groups average 783 seconds on the former and 834 seconds on the latter while the mixed groups take 694 seconds on the first and 493 seconds on the second. The trend of the female groups is in the opposite direction from the other but the difference is rather small. Considering all groups together disregarding sex those doing the "ad lib" series average 865 seconds and those under time limit 788 seconds. This suggests again an increase in efficiency under a time limit. This tendency is clearer in the case of the male groups and the mixed groups.

Combining the results of all groups the males average 1022 seconds on the "ad lib" series and 749 seconds on the time limited series; the females 923 seconds on the former and 508 seconds on the latter; the mixed groups average 896 seconds on the first and 482 on the second. Thus in the groups when timed the males are 25 per cent more efficient; the females 44 per cent; and the mixed 46 per cent.

When we disregard sex and find the average we get 947 seconds on the "ad lib" series and 579 seconds for the time limit series. The groups on the time-limited series are 38 per cent more efficient. The practice effect in this type of material shows groups with practice to be 15 per cent quicker. This leaves a clear superiority of 23 per cent for the groups with a time limit. It seems quite clear that the committees doing such work as Bridge Problems are much more efficient working under a definite time limit.

The results for the Judgment of English Composition—the fourth type of material used—are shown in table 8. The general plan of procedure was the same as that used with the other three types of materials. It should be noted that accuracy was calculated in terms of coefficients of correlation

between the ratings made by the group and the Thorndike ratings of the compositions.

The male groups on Series I "ad lib" take 1114 seconds and have an accuracy of 0.4 while on Series II with a time limit of 15 minutes they average 708 seconds with an accuracy of 0.76. The females average 967 seconds and 0.69 on the former and 559 seconds and 0.76 on the latter. The mixed groups average 1130 seconds and 0.57 on the first and 688 seconds and 0.72

TABLE 8

Grading English Compositions

	SERIES I. "AD LIB"		SERIES II. TIME LIMIT	
	Time	Accuracy	Time	Accuracy
	seconds		*seconds*	
Male groups	1,114	0.4	708	0.76
Female groups	967	0.69	559	0.76
Mixed groups	1,130	0.57	688	0.72
Average	1,070	0.55	651	0.74
	SERIES II. "AD LIB"		SERIES I. TIME LIMIT	
Male groups	1,113	0.74	716	0.49
Female groups	831	0.65	644	0.69
Mixed groups	1,154	0.69	828	0.75
Average	1,032	0.69	729	0.64

on the second. When all three types of groups are considered together the average time on Series I "ad lib" is 1070 seconds with an accuracy of 0.55 and on Series II time limited is 651 seconds with an accuracy of 0.74. These groups show that when they are given a definite time limit they are quicker and more accurate. This seems more characteristic of the male groups.

The male groups doing Series II "ad lib" average 1113 seconds and score 0.74 in accuracy while on Series I with a

time limit they take 716 seconds and score 0.49 in accuracy. The females average 831 seconds in time and 0.65 in accuracy on the "ad lib" series and 644 seconds and 0.69 on the series with a time limit. The mixed groups average 1154 seconds and 0.69 on the "ad lib" series and 828 seconds and 0.75 on the series with a time limit. When the results for all three types of groups are pooled the average of the groups on the "ad lib" series is 1032 seconds and 0.69 in accuracy against 729 seconds and 0.64 on the series with a time limit. The time limited groups are only slightly less accurate but 29 per cent quicker than the "ad lib" groups. Thus the time limited groups are much more efficient.

Considering all the groups on "ad lib" series versus the series with a time limit the males average 1113 seconds and 0.54 on the "ad lib" series and 712 and 0.62 on the time limited series. The females average 894 seconds and have an accuracy score of 0.76 on the former and take 601 seconds and have an accuracy score of 0.72 on the latter. The mixed groups have an average time of 1142 seconds with 0.63 for accuracy on the first and 758 seconds time with 0.73 in accuracy on the second.

Combining all the groups an average of 1051 seconds is required with an accuracy of 0.62 for the "ad lib" series and an average of 690 seconds and an accuracy of 0.69 for the series with the time limit. Thus the timed groups are slightly more accurate and 34 per cent quicker.

The practice effect in the case of Judging English Compositions seems greater than in any of the other materials. Groups with practice are 22 per cent quicker and 23 per cent better in accuracy. This renders the foregoing results with the compositions somewhat less significant but it is still interesting to find their trend in the same direction as that for the other three types of material.

INTROVERTS AND EXTROVERTS ON COMMITTEES

Recent work in applied psychology is devoting considerable attention to the analysis of personality and temperament. Techniques are being perfected for the measurement of these

characteristics and we are discovering their importance in many practical situations, for instance, vocational adjustment. It occurred to the writer that these things might likewise play a rôle in committee efficiency. Committees may be composed of widely varying personalities or may be rather homogeneous. We stated above that a committee comprising members of both sexes was somewhat inferior. It is possible that homogeneity in personality or temperament should function similarly to homogeneity in sex in affecting committee efficiency. At any rate this seems a profitable field for further study. Limitation of time, however, made it possible to select only a minor phase of this large problem and study it in a preliminary way. The results are to be regarded as suggestive of the problem rather than as final conclusions. The experiments were devoted to a single personality variable that is being studied considerably of late, viz., introversion versus extroversion. Recent contributions to the study of this variable have been made by Freyd (6), Laird (7) and Heidbreder (8).

In selecting introvert and extrovert subjects for this experiment a questionnaire as prepared by Thompson (9) was used. It is a modified form of that originally developed by Laird. The directions and a few typical items are as follows:

DIRECTIONS

Answer the following questions regarding yourself by placing the number of the phrase that most accurately describes you in the small blank to the right of the question. In answering think back over your experience for the past few months and answer as accurately as you can. The answers to the questions are strictly confidential and will be used in no way for or against you. The only "right" answer is the most accurate one. Take as much time as you wish but be accurate. Select that phrase that most accurately describes you.

1. Are your friends and acquaintances limited? (1) to members of your family, (2) to a select few, (3) to a fairly large number, (4) all except those who are not respectable, (5) unlimited. ——

2. How often do you feel hurt? (1) sensitive to every remark, (2) sensitive to most remarks made in seriousness, (3) only to those remarks that are emphatic, (4) rarely, (5) never. ——

3. Do you study the motives of others? (1) seldom give them a thought, (2) occasionally consider them, (3) try to unmask important ones, (4) usually try to discover motives, (5) suspicious of most motives. ——

4. Do possible misfortunes disturb you? (1) worry about them, (2) usually think what might happen, (3) occasionally give them some thought, (4) pay little attention, (5) never bother me. ——

5. How do you act when things go wrong? (1) pity yourself much, (2) feel blue and complain, (3) feel blue but do not complain, (4) become somewhat excited, (5) don't care much. ——

The subject checked the one of the five items under each question which best described his own condition. The final score was determined by totaling the number of points checked, for instance no. 3; no. 5; no. 1, etc. The lowest score possible was 51 while the highest was 255. Individuals making high scores are classed as extroverts while those making low scores are introverts. The following four groups were used:

1. Four male introverts
2. Four female introverts
3. Four male extroverts
4. Four female extroverts

In selecting problems for these committees the Photographs Portraying Emotions and the Multiple Choice Problems were the materials used. These two represent the most extreme types of problem used in the previous experiments,—one being concrete and appealing to the personal interest and the other being distinctly abstract. It seemed probable that these would catch any prominent difference between introverts and extroverts in the type of material with which they will deal most effectively.

When we examine the results for the Multiple Choice Problems (table 9) we find the extrovert male group requires 925 seconds and 75 keys, the introvert males 416 seconds and 80 keys. The introvert males are 55 per cent quicker and 6 per cent less accurate. The Extrovert female group take 551

seconds and use 88 keys; the Introvert female group take 560 seconds and use 87 keys. The introvert females are 16 per cent slower and 1 per cent more accurate. When the male and female groups are combined the introverts are 33 per cent quicker and 2 per cent less accurate than the extroverts on this type of material.

We find that the group of 4 extrovert males in using the Photographs Portraying Emotions (see table 10) take in all 135 seconds with 12 photographs correct. On Series II this same group takes 164 seconds and get 9 photographs correct. When we average the results on both series they take 149

TABLE 9

Multiple Choice Problems

	TIME	ACCURACY
	seconds	
Extrovert male groups	925	75
Extrovert female groups	551	88
Average	738	81
Introvert male groups	416	80
Introvert female groups	560	87
Average	488	83

seconds and get 10+ photographs correct. With the Photographs Portraying Emotions the introvert males use on Series I 140 seconds and get 9 photographs correct while on Series II they take 235 seconds and get 6 correct. On the two Series they average 187 seconds with 7 photographs correct. The extrovert females on Series I use 63 seconds and get 12 photographs correct while on Series II they take 97 seconds with 12 correct. Combining their results on both Series they take 80 seconds and get 12 correct. The introvert females on Series I take 202 seconds with 8 correct; on Series II 122 seconds and 8 correct. On both series they average 162 seconds and 8 photo-

graphs correct. The extrovert females are 50 per cent quicker and 33 per cent more accurate than the introvert females.

When we combine all groups disregarding sex and series the extroverts take 114 seconds with 11 photographs correct

TABLE 10

Photographs Portraying Emotions

	TIME		ACCURACY	
	seconds			
Extrovert male groups:				
Series I	135		12	
Series II	164		9	
Average		149		10
Extrovert female groups:				
Series I	63		12	
Series II	97		12	
Average		80		12
Grand average, extrovert	114		11	
Introvert male groups:				
Series I	140		9	
Series II	235		6	
Average		187		7
Introvert female groups:				
Series I	202		8	
Series II	122		8	
Average		162		8
Grand average, introvert	199		7	

and the introverts 199 seconds with 7 correct. The extroverts are 42 per cent quicker and 45 per cent more accurate than the introverts. Findings with both types of material suggest that introversion and extroversion play a rôle in committee efficiency and are worthy of more intensive study.

SUMMARY AND CONCLUSIONS

The following general conclusions have been drawn from the data presented on each of the last three phases of this experiment on committee efficiency as discussed in this article:

Sex of committees

I. Experimental data show that a committee all of one sex is more efficient than a committee composed of both sexes. Mixed groups tend to get off the subject. This is especially true with a concrete and personal task.

II. The type of problem given the committee to solve also cuts across the sex variable.

1. In Interpreting Photographs Portraying Emotions the women do better than the men. The women seem to find this material of a personal type and seem very much interested in it. The men however do not seem so much interested, speed up and are more inaccurate.

2. In the Multiple Choice Problems the males are slower and more accurate than the females. This is an abstract type of material and the females are not so much interested in it, so they speed through and are inaccurate. On the other hand this abstract situation appeals to the men; they are more interested and do better.

3. With the Bridge Problems the females are quicker than the males and do not seem to differ in accuracy. They proceed in a less meticulous fashion.

4. In the case of the English Compositions the female groups are quicker and more accurate. This material seems of a personal and interesting type.

III. The sex variable is still further influenced by the size of the group.

1. The tendency for the females to be superior in judging the Photographs Portraying Emotions and in judging English Compositions and vice versa, is more marked with groups of 3 than with groups of 6. However, this tendency is present in both cases.

IV. A limited amount of time in which to act is another factor which differentiates sex groups. In most cases the time limit is less conducive to increased efficiency of female groups than of male groups.

Effect of time limit on committee efficiency

I. The experimental data of this discussion tends to show that with the four types of material the groups respond more quickly with the same, and in many cases greater, accuracy when they are given a definite time limit than when they work "ad lib." They do not tend to go into so many blind alleys.

II. The male groups show a slightly larger increase in speed and accuracy under a time limit than do female and mixed groups.

Introvert versus extrovert

I. With the four kinds of material there seems to be no general trend for introverts or extroverts to be superior on all types of problem.

II. Efficiency as far as introversion or extroversion is concerned depends largely on the type of problem to be solved.

III. In general extroverts are better on the concrete and personal type of problem. In this type, such as the Pictures Portraying Emotions, each individual comes to the problem with his own solution and it is a matter of the group convincing certain members that they are wrong. It may be that the introvert is not so effective in argument and avoids controversy. The introverts are distinctly better on the Multiple Choice Problem. There each member adds his part by helping check a theory and personally pre-conceived opinions do not enter. The foregoing conclusions are of course subject to the limitations imposed by the use of only four kinds of committee task and the use of college students as subjects. However, the tasks used ranged from the concrete and personal to the highly abstract and would seem to give as fair sample of committee action as could be obtained under laboratory conditions. Con-

sequently, the writer is disposed to feel that the tendencies brought out in these experiments are of rather general applicability. Size, sex, personality and time limit all play their rôle in committee efficiency. Many other problems in this field of course await the experimental approach but the foregoing are at least suggestive. There is little doubt but that the selection and administration of committees along psychological lines would save the political, industrial and academic world a tremendous amount of unnecessary time and effort.

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ON SORTING PACKS OF SIXTY CARDS WITH FORM AND COLOR AS VARIABLES IN TWO TO SIX KINDS

Card Sorting by Reaction to the Previous Card

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WIDE USE OF THE SORTING TEST

For serial reaction no method is simpler to provide and none is more generally in use than card sorting. A host of studies in motor ability have employed this test.[1] As examples we list a few of the more important. Brown[2] conducted a longer experiment than the one described here, his subjects completed a total of 92 sortings in 13 days, using ordinary playing cards. Calfee[3] compared sorting times for numbers and letters with random dealing time, and found that sorting by letters was the slowest method. Cornell[4] used forms and colors, much as in our study, but had both on the same cards, so direct comparisons are impossible. English[5] compared letters and figures. Link[6] had his subjects separate the O's from other letters.

[1] For a good bibliography on this subject see: C. F. Hansen, Serial action as a basic measure of motor capacity. Psych. Mon., 1922, vol. 31, 320–382.

[2] W. Brown. Habit interference in sorting cards. Univ. of Cal. Pub., 1914, vol. 1, 269–321.

[3] M. Calfee. College freshmen and four general intelligence tests. Jour. of Educ. Psych., 1913, vol. 4, 223–231.

[4] C. B. Cornell. A graduated scale for determining mental age. Jour. of Educ. Psych., 1917, vol. 8, 539–549.

[5] H. B. English. An experimental study of mental capacity of school children, correlated with social status. Psych. Mon., 1917, vol. 23, 266–331.

[6] H. C. Link. An experiment in employment psychology. Psych. Rev., 1918 vol. 25, 116–127.

Perrin[7] used the card sorting test as one of a battery of 17 motor tests, having ordinary cards sorted three times by each person. Mistakes added 0.02 minute to the time score. Woodrow[8] worked with children on sorting forms pasted on gun wads, allowing 4 minutes for as many as possible to be sorted. He found feeble-minded and normal children were practically equal in both initial scores and gain with practise. Whitley,[9] among other tests, had his subjects sort series of colors, shapes, and sizes. The colors were of all shapes and sizes; the shapes of all sizes and colors; while the different sizes were all discs but of varying diameters and colors. Sorting by color and size took about the same time, while shapes required almost 50 per cent increase in time to sort. Countless comparisons have been made between sorting and dealing times. Special sorting bins, such as the Jastrow apparatus[10] have occasionally been used, but mostly a collection of four ordinary cardboard boxes has served, and a deck of common playing cards, sometimes with the face cards removed, has constituted the materials to be sorted. Four has been the favored number for the variety of cards and indeed this is true in other reaction-discrimination situations where more elaborate apparatus has been constructed. Examples of these are McComas's[11] continuous discrimination apparatus with reactions to differently colored lights; and R. H. Seashore's[12] serial reaction apparatus, in which the subject uses the four fingers and reacts to visual number stimuli. In these latter doubtless the fact that the human hand has four

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[8] H. Woodrow. Practise and transference in normal and feeble minded childred. Jour. of Educ. Psych., 1917, vol. 8, 85–96.

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fingers so placed that they can efficiently play upon the four aligned keys has been the determining consideration.

On the side of method the bit of work which we report has two distinctive features: (*a*) sorting by the "out-of phase" or "one-behind" method, and (*b*) sorting of several decks each with the same total number of cards but with varying numbers of suits.

SORTING BY REACTION TO THE PREVIOUS CARD

This method may be called the "one-behind" or "one-ahead" according to the way you think of it. As a sorting procedure it has been in use at the Stanford Laboratory for several years[13] and consists essentially of the following routine: with the deck held face down, throw a card to the upper left hand box with a swift movement so that it will fall face up, then throw the second card into the box which bears the same suit designation as the first card shows on its face. Card no. 2 shows where to throw card no. 3 and so on. The method can of course be made more complex by sorting more than one behind.

The advantages of this method are fivefold:

1. Direct comparisons of dealing and sorting are possible as the suit of a card is not identified while it is in the hand. You *deal* by throwing face up to the trays in order and *sort* by throwing face up to the trays as called for. The hand-arm movement is identical for both.

2. The sorting movement may be made as one swift, continuous coördination without the complicated turn to show the face of the card before giving it the specific directional flip.

3. Vision may be directed to the trays, as the hand movements need little visual guidance, particularly in the vicinity of the deck. This makes for accuracy of placement and reduces visual strain, as the task for vision is carried on at practically a constant distance.

[13] Before 1922 it was used by Miss Gertrude M. Trace, instructor in psychology at Stanford in a regular experiment devised for the class in elementary laboratory psychology. It was she who introduced it to me.—W. R. M.

4. Reacting to the previous card demands a more steady attention. In ordinary sorting the work may be interrupted and taken up without any confusion resulting. With this new routine there is an "overlap" between cards and this hold-over phase cannot be neglected if the subject is to succeed well with the task. The work may be termed *continuous as contrasted with discrete reactions.*

5. The deck used remains uniformly well shuffled. All that is necessary is to stack up the cards from the various trays at the end of a sorting and the deck is ready to use again.

A desirable feature with this method is that the trays should be shallow and not too large in base area. The subject corrects errors when he notices them, which is usually the case. The person giving the test counts the uncorrected errors during the sorting. At the end, however, there is a check which may be used. Each tray should have been called for the same number of times. Therefore, if one card is taken from the upper left hand box where the first card was arbitrarily thrown, and placed in the box called for by the last card to be thrown, then each tray should contain the same number. The one exception is this: if the last card of the deck calls for the upper left hand box then no card need be shifted and the trays should check in number if uncorrected errors have not been made. Of course, occasionally two errors might cancel each other. With adults at least these uncorrected errors are usually rare.

A CONSTANT NUMBER OF CARDS WITH A CHANGING NUMBER OF SUITS

A great saving of testing time can be effected by having at hand and all arranged more than one deck, if differing numbers of suits are to be tried. Sixty cards is a very convenient number for the deck in these sorting tests—convenient in size of pack for the hand and also in being evenly divisible by two, three, four, five, and six.[14] The advantage of keeping the total

[14] This scheme of using decks of 60 cards divided equally among two three, four, five and six suits was devised by one of us (W. R. M.) in January, 1924.

number of cards in each deck the same is too clear to need discussion.

The cards used were regulation commercial playing cards of standard size and of excellent quality, procured with blank face. They were divided into packs of sixty each. Five such packs were painted with black water-color according to forms and five other packs by colors. Pasting on the appropriate form or color would make the deck clumsy. The forms

TABLE 1

A battery of card sorting decks for contrasting form with color and for studying the influence of varying the number of suits

DECK NAME	COLORS: NUMBERS OF EACH COLOR CARD USED						TOTAL CARDS
	Blue	Yellow	Red	Green	Gray	Violet	
2 Color	30	30					60
3 Color	20	20	20				60
4 Color	15	15	15	15			60
5 Color	12	12	12	12	12		60
6 Color	10	10	10	10	10	10	60
	FORMS: NUMBERS OF EACH FORM CARD USED						
	Cross	Diamond	Disk	Square	Half-disk	Triangle	
2 Form	30	30					60
3 Form	20	20	20				60
4 Form	15	15	15	15			60
5 Form	12	12	12	12	12		60
6 Form	10	10	10	10	10	10	60

chosen were: Maltese cross, diamond, disk, square, half-disk, and triangle. For the series of color decks blue, yellow, red, green, gray, and violet were chosen.

The colors were painted at the center of each card, within a circle drawn the size of a dime, that is, 18 mm. in diameter.

The forms were likewise painted at the center of each card in solid black paint, and of areas equal to the color cards.

The trays employed were covers from small cardboard boxes, which measured $8\frac{1}{4}$ inches long, $6\frac{1}{4}$ inches wide, and $1\frac{1}{4}$ inches

deep. They were connected in two rows of three each. The arrangement was worked out so that the distances the cards would have to be thrown would be as nearly as possible the same for each number of choices, as may be seen from figure 1. Thus in the pack of two kinds the boxes used are the upper left and lower middle (labeled 1 and 2); then are added in order the upper right, lower left, upper middle, and last the lower right. All boxes are left in place whether used or not, to keep conditions uniform. On the far edge of each box (from the subject) the symbol of the card that names the box is painted. For example box 1 has a blue disk facing the subject; box 2 a yellow; 3, 4, 5, and 6 are respectively red, green, gray, and violet. Likewise for forms. The boxes are arranged so that the same ones can be used for both form and color sorting;

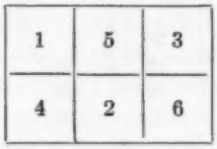

FIG. 1

they merely need to be turned around to expose the symbols for the other series. The stop watch was started when the first card was thrown into the upper left-hand tray and stopped when the last card hit its box.

EXPERIMENTAL PROCEDURE

Our object in this study was to examine by a relatively brief series for each subject, whether serial reaction is quicker for colors or for forms and also whether the reaction time is significantly changed by increasing the variety of stimuli consistently from two to six inclusive. Each subject sorted each pack twice, but not in succession. At the beginning of the test the purpose and the principle of sorting was explained so that the subject understood that the reaction in this test is made to the previous card, rather than to the card being handled. As

illustration let us assume that the first card was a diamond; the next one whatever it might be must be thrown to the box labeled with a diamond. This of course is contrary to the usual method of sorting each card by itself. Needless to say the cards were held back up so that the subject would not see the mark on any card until it fell face up in the box.

After being shown the principle of the test, a few cards were thrown slowly by the experimenter (R. W. H.) to illustrate and then the subject was given about a third to a half of a pack and told to throw them to their appropriate boxes slowly so that any difficulties or misunderstood points could be cleared up before the real test began.

After the subject had practised with the few cards he was given the pack of six varieties and told that this first attempt was considered a trial, and that while time on it was being taken it would not be used in the final data. Then he sorted the same pack again; after this the pack of five choices; then four, three, and two in order. Then he went up the scale: two, three, four, five, and six. After this he did the other half of the experiment; that is, if he sorted colors first he then sorted forms. The procedure was exactly the same as before. Half of the subjects sorted color first; the rest, form first and color second. In this manner the pack of six kinds was sorted first and tenth; that of five kinds came second and ninth; and so on.

Some of the subjects finished the whole experiment at one sitting of about one hour, while the others had the two parts separated anywhere from one day to a week. This made no appreciable change in the results, as the second half was somewhat different from the first and the subject was allowed, as in the beginning, to throw a few cards to locate the bins and to warm up; then he had the trial sorting with the pack of six varieties.

Errors were counted in the first part of the experiment, but were found so few as to be of no value in drawing conclusions. They were rare and inconsistent as to location in the test. By error we mean mistakes which were undetected at the moment of sorting. The subjects were told to correct those mistakes

which they noticed. The emphasis was laid on speed rather than on accuracy, although the subject was not permitted to feel that he might throw the cards around at random to gain time. The experimenter watched and checked up mistakes. A count at the end of sorting gave a fairly accurate further check on errors. The subject was told not to allow himself to become "rattled;" that everyone had blocks; and that he should

TABLE 2

Sorting time scores for 10 subjects who began their tests with the color decks

(Time in seconds)

DECK	SUBJECT NUMBER*										AVERAGE	TIME PER CENT
	1	*6*	7	*8*	9	*12*	14	16	*18*	*20*		
Trial	76.4	93.8	160.0	84.0	112.0	92.4	58.2†	82.2	49.4†	64.8	87.3	12.95
6	69.2	60.8	104.6	71.6	67.4	72.2	53.8	79.8	51.8	56.8	68.8	10.20
5	58.8	65.8	81.0	67.2	66.6	84.8	60.2	76.4	50.0	52.0	66.3	9.83
4	55.6	66.8	73.8	64.2	64.0	75.6	52.0	72.8	47.0	51.0	62.3	9.23
3	44.2	74.6	81.0	57.8	56.0	75.4	45.4	71.6	50.0	49.6	60.6	8.98
2	38.6	57.0	58.2	56.6	50.8	60.0	47.4	53.4	47.0	44.6	51.4	7.61
2	45.4	56.8	57.8	52.8	43.2	55.4	49.8	60.4	47.0	46.8	51.5	7.64
3	44.2	54.4	74.0	60.0	51.8	64.8	55.8	61.8	50.4	54.2	56.2	8.34
4	48.2	62.2	65.6	54.6	55.0	65.0	48.6	65.6	47.4	49.6	56.2	8.33
5	51.6	71.6	56.4	56.0	54.8	64.4	52.8	63.0	50.2	49.0	57.0	8.45
6	55.0	56.6	60.0	57.8	64.0	61.2	47.0	67.0	53.2	47.6	56.9	8.44
Average‡	51.1	62.7	71.2	59.9	57.4	67.9	51.3	67.2	49.4	49.2	61.3	100.00

* Subjects numbered in italics are women.

† In these cases the practice trial took less time than later trials by the same subject.

‡ Averages do not include the trial sorting.

keep as calm as possible. This was to eliminate self-judgment of being "dumb" or a poor subject. However, it was very lightly touched upon to avoid suggestion.

COMPARATIVE CARD SORTING RESULTS

Crude scores. The scores appear in tables 2, 3, 4 and 5. The average at the foot of each column represents the total

number of seconds occupied by the subject in sorting the ten packs of cards in each half of the test, excluding the first trial sorting from the sum, though the figures for it are given in the table. At the right hand side of each table are two columns headed respectively "Average" and "Time, Per cent," the first showing the average number of seconds occupied in the sorting

TABLE 3

Results for 10 subjects who used the form decks in the second half of the experiment

(Time in seconds)

DECK	SUBJECT NUMBER*										AVERAGE	TIME PER CENT
	1	*6*	7	*8*	9	*12*	14	16	*18*	*20*		
Trial	57.2	61.6†	81.4	69.2	74.6	72.4†	48.4†	66.8†	60.2	53.6	64.5	11.02
6	52.0	63.6	68.8	65.6	62.4	74.4	49.8	61.6	54.2	48.4	60.1	10.26
5	54.0	57.6	66.4	58.2	53.4	69.6	47.4	62.4	49.0	49.0	56.7	9.68
4	50.6	58.0	68.0	55.0	50.0	72.8	50.0	53.2	45.0	47.4	55.0	9.40
3	54.0	54.2	56.4	55.0	42.0	63.4	42.2	50.6	41.2	46.6	50.6	8.63
2	41.6	48.4	47.6	62.2	37.0	54.2	40.0	50.0	38.4	48.4	46.8	7.99
2	44.0	43.6	41.0	47.4	36.2	50.8	42.2	49.6	42.6	43.3	44.1	7.41
3	43.0	43.8	47.2	57.0	38.6	63.4	47.4	47.2	46.4	47.0	48.1	8.22
4	46.2	56.8	52.0	49.2	43.6	62.2	48.6	60.0	44.0	46.4	50.9	8.68
5	50.0	53.2	56.4	59.2	49.0	61.0	47.8	53.4	47.0	50.0	52.7	9.00
6	56.8	55.8	50.8	58.0	53.2	64.8	49.6	71.4	50.6	48.4	55.9	9.55
Average‡	49.2	53.5	55.4	56.7	46.5	63.7	46.5	55.9	45.8	47.5	53.2	100.00

*Subjects numbered in italics are women.

† In these the preliminary trial took less time than later trials by the same subject.

‡ Totals do not include the trial sorting.

of each deck, and the second showing the percentage of the grand total time spent in each trial. These figures include the first, or practice, trial.

Form and color. Our group is not large enough to completely settle whether form or color is sorted faster, but should give some indication, particularly considering the uniform results. In table 6 we place in the first column the total time used by

the ten subjects who started with color-sorting, and below this the total for those beginning with form; the second column gives the total time occupied in sorting color or form in the second part of the experiment; the third gives the total time spent in sorting colors and forms, with the percentage of the total time spent on the whole experiment used in each half.

TABLE 4

Sorting time scores for 10 subjects who began their tests with the form decks

(Time in seconds)

DECK	SUBJECT NUMBER*										AVERAGE	TIME PER CENT
	3	*4*	*5*	*8*	*10*	*11*	*13*	*15*	*17*	*19*		
Trial	81.8	57.0†	68.4	95.6	127.2	66.8	81.0	60.6†	108.6	75.6†	82.3	11.81
6	64.8	56.4	59.4	85.6	98.4	55.0	75.8	68.6	98.4	64.0	72.6	10.43
5	64.4	48.4	55.4	81.0	90.0	56.6	70.2	67.8	91.2	64.6	69.0	9.90
4	53.6	57.2	54.2	69.8	101.0	57.2	62.0	62.0	83.8	53.4	65.4	9.39
3	56.2	46.6	50.2	64.4	93.6	57.4	58.2	51.8	69.4	55.2	60.3	8.66
2	53.0	51.8	44.0	62.4	81.0	44.8	55.0	42.2	59.4	60.8	55.4	7.96
2	44.0	51.0	43.8	57.6	81.6	49.2	47.8	49.0	70.0	78.0	57.2	8.21
3	47.2	45.8	46.4	60.0	91.0	54.8	53.6	51.2	55.8	57.2	56.3	8.09
4	53.0	46.2	53.4	65.8	80.0	60.0	50.8	56.0	67.8	59.6	59.3	8.52
5	50.6	49.0	50.2	64.8	79.4	55.0	58.4	52.6	65.8	58.4	58.4	8.39
6	52.2	57.2	50.4	64.0	74.4	54.4	55.4	64.0	66.8	62.3	60.0	8.61
Average‡	53.9	51.0	50.7	67.5	87.1	54.4	58.7	56.5	72.8	61.4	63.3	100.00

* Subjects numbered in italics are women.

† In these cases the first practice trial with the 6 deck did not take longer than later trials by the same subject.

‡ Totals do not include the trial sorting.

As far as the total time goes, there is very little difference between color and form. Color has about one per cent advantage which may indicate a tendency, but owing to only ten cases being used each way the probable error is greater than the difference. However, the difference in the first half of the experiment between those starting with color and those beginning with form is noticeable. Those sorting forms first take an average of 4.6 per cent longer. In the second half of

the experiment form-sorting is faster than color-sorting, but the difference is only 18.6 seconds totally, or 0.34 per cent. One subject could have altered this relative standing by taking a little less than two seconds longer on each trial, which is actually much less than the standard deviations.

TABLE 5

Results for ten subjects who used the color decks in the second half of the experiment

(Time in seconds)

DECK	SUBJECT NUMBER*										AVERAGE	TIME PER CENT
	3	*4*	*5*	*8*	*10*	*11*	13	*15*	17	19		
Trial	54.0	46.6†	60.0	67.8	94.6	58.0†	56.6	62.2†	82.6	73.2	65.6	11.14
6	51.2	44.8	53.4	57.8	76.2	54.2	53.6	71.0	76.8	58.4	59.7	10.15
5	46.4	44.0	46.6	57.4	76.4	52.2	49.6	51.8	75.0	59.0	55.8	9.49
4	47.0	47.0	47.0	59.0	73.0	49.8	54.8	52.0	71.6	49.6	55.1	9.36
3	44.8	46.2	41.8	48.6	86.2	47.8	48.4	43.8	61.4	46.0	51.5	8.75
2	39.8	41.0	43.0	54.4	55.6	59.2	41.8	38.4	56.0	46.4	48.6	8.25
2	39.0	46.4	34.0	43.2	82.0	53.8	43.2	42.8	56.2	47.0	48.8	8.28
3	44.8	44.8	39.4	53.0	68.0	49.4	47.4	43.6	64.2	48.8	50.3	8.56
4	44.6	44.0	38.4	54.0	64.0	49.4	48.8	46.8	64.6	49.2	50.4	8.56
5	45.0	49.4	39.4	55.2	58.8	45.6	54.8	46.2	65.8	48.0	50.8	8.64
6	41.8	41.4	47.4	49.8	70.6	47.8	52.0	48.0	66.6	51.6	51.7	8.79
Average‡.	44.4	44.9	43.0	53.2	72.1	50.9	49.4	48.4	65.8	50.4	53.5	100.00

* Subjects numbered in italics are women.

† In these cases the first practice trial with the 6 deck did not take longer than later trials by the same subject.

‡ Averages do not include trial sorting.

On the whole experiment those starting with color and sorting forms second take 2.5 per cent less time totally than those doing the experiment in reverse order. This may reflect a slight difference between the groups.

Different numbers of choices. Let us now consider the effect on time of having to react to a differing number of choices. This comparison will involve the final percentage columns in tables 2, 3, 4 and 5, which are grouped in table 7 together with

averages for color, for form, and for these combined. The first column shows the percentage of total time spent on each item when color was sorted first; the second column gives the same when color was sorted after form; the third is the average of

TABLE 6

Time spent in different parts of the experiment

(Time in seconds)

	FIRST HALF	SECOND HALF	TOTAL	PERCENTAGE
Color	5,871	5,226	11,098	49.4
Form	6,140	5,208	11,348	50.6
				seconds
Color first and form second				11,079
Form first and color second				11,367

TABLE 7

Comparison of percentage time for sorting decks of cards with the suits varying from two to six inclusive

CHOICES	COLOR			FORM			TOTAL TEST
	First	Second	Average	First	Second	Average	
Trial	12.95	11.14	12.04	11.81	11.02	11.41	11.73
6	10.20	10.15	10.18	10.43	10.26	10.35	10.26
5	9.83	9.49	9.66	9.90	9.68	9.79	9.72
4	9.23	9.36	9.30	9.39	9.40	9.40	9.35
3	8.98	8.75	8.87	8.66	8.63	8.65	8.73
2	7.61	8.25	7.93	7.96	7.99	7.98	7.95
2	7.64	8.28	7.96	8.21	7.41	7.81	7.89
3	8.34	8.56	8.45	8.09	8.22	8.15	8.30
4	8.33	8.56	8.45	8.52	8.68	8.60	8.52
5	8.45	8.64	8.55	8.39	9.00	8.70	8.62
6	8.44	8.79	8.61	8.61	9.55	9.08	8.85

the first two columns; the fourth, fifth, and sixth show parallel results for form-sorting; the seventh is the total for the complete test. In this last column we see a steady decline in time down to the second sorting of the pack of two choices; after

this the time percentage increases regularly but by very slight amounts. The rise in no way compares with the decrease in the first half when the number (variety) of discriminations is diminishing. This may indicate that learning and decreasing difficulty make the rate of progress doubly noticeable in the first half of the test, while the two are opposed to each other in the latter half. Learning is undoubtedly slowed down as the subject is approaching his ultimate plateau, but the increasing difficulty probably remains the same. The rise from 7.89 to 8.85, a change of 12 per cent shows that the difficulty is more than the improvement from learning which is still going on. In other words increasing the number of suits does somewhat increases the difficulty.

In comparing the items with two choices, where the same pack is sorted twice in succession, the only place in the experiment that this happens, the total results show a slight decrease in time in the second sorting. But one sees that in three of the four columns the time increases slightly, while the fourth shows enough difference in the other direction to cause the total results to show improvement. The general impression from watching the subjects was that the increase in time in the second trials was due to desire for haste causing errors.

Standard deviations. In the initial trial sorting there is a very wide difference between subjects, but on the last sorting they are quite close together. Of course there is much more room for improvement on the part of those starting slowly, as the others begin at a point much nearer what we may suppose as the motor limit. But on the other hand, why should there be a higher rate of improvement by the slow starters? Suppose their time is cut in half, why is not the time for the faster starters similarly reduced?

Let us examine the variations which appear in table 8. Columns 1 and 3 show the deviations in the first half of the experiment for color and form respectively, while columns 2 and 4 give the deviations in the second half, for form and color respectively. There is a far greater difference at the beginning than at the end of the first half; and the second half remains

more constant throughout. Form has a slightly larger average standard deviation than color, the average being 12.9 seconds, as contrasted with 10.4 seconds for color. There is less deviation when color is sorted first and form second, the time variation for color sorting being 9.4 seconds as compared with 13.0 seconds variation for the subjects taking the experiment in reverse order.

Are the deviations any less for sorting with less discriminations than with the packs calling for a higher number of choices?

TABLE 8

Standard deviations for 20 subjects who sorted decks of sixty cards with form and color and number of suits as variables

(Results given in seconds)

	1 COLOR FIRST	2 FORM SECOND	3 FORM FIRST	4 COLOR SECOND	5 AVERAGE
Trial	29.84	9.67	21.14	11.30	17.96
6	14.62	8.16	13.34	10.03	11.51
5	11.27	8.24	13.73	10.88	11.03
4	9.79	8.40	14.79	10.58	10.14
3	12.92	7.00	12.39	12.61	11.23
2	6.20	7.40	10.93	6.28	6.13
2	5.52	4.05	11.12	12.64	8.33
3	8.67	7.25	12.42	8.14	9.12
4	7.33	6.31	9.06	7.97	7.67
5	6.83	4.58	8.93	7.38	6.93
6	6.19	6.94	7.12	9.13	7.35

We cannot average say the first and second sortings of one pack when they occur at different points in the whole test, as learning is probably more responsible for decrease in variations than is the number of choices. There is a decrease down to two choices; it remains about constant during the rest of the test, while the subject goes up the "scale." In the early part of the second half of the test the deviation goes a little higher than it stood at the end of the first half, but soon comes down to the former low level. However, it does not go much below that level, although in the half where form was sorted second it does fall a bit lower.

Correlations. The subjects were ranked in order in both parts of the test, in the whole test, and in the first trial. The correlations between the parts of the test and the whole total are spuriously high, as the test itself has a half-bearing on the whole result. If more than two parts had composed the test, one part could have been correlated against the rest by the partial correlation technique, but this was obviously impossible here. As a whole the correlations are very high; partly so because there are comparatively few subjects and consequently a greater separation between each, and also because the two parts of the test are identical in manner of sorting and in order of the packs. In both parts it will be noticed that the highest

TABLE 9

Rank correlations between scores made in sorting various decks of 60 cards

A. Form sorted first; color second.	
1. Between form and color	0.92
2. Between form and total	0.98
3. Between color and total	0.95
4. Between first trial and total	0.77
B. Color sorted first; form second.	
1. Between color and form	0.75
2. Between color and total	0.96
3. Between form and total	0.86
4. Between first trial and total	0.79

correlation is between the first part of the test and the total rank. This seems peculiar, but it will be remembered that the subjects were grouped closer in the second part of the test than in the first part. Since they were thus more closely grouped any small variations would be of more comparative effect and so alter the subject's standing in that portion of the test.

The comparative ranks of the subjects as to trial sorting and total test rank show that all subjects do not improve equally throughout the test, as the lowest correlation is found here. In fact some subjects who turned out to be among the fastest were very slow in the trial sorting. This may be due to trying consciously to perfect a system in sorting, or possibly to slowness in catching on to the technique of the experiment.

Sex differences. We group together those who started the test first with color and those beginning with form, since we found little difference in the totals between the two kinds of discrimination. There were 9 male and 11 female subjects. The males rank as follows: 1, 7, 8, 9, 13, 14, 17, and 19; the females, 2, 3, 4, 5, 6, 10, 11, 12, 15, 18, and 20. The average rank for the men was 11.6 as contrasted with 9.7 for the women. The impression from watching the experiment was that the women were even faster comparatively than the results show. However, the results would show a wider discrepancy but for the one man at the head of the list, as the women take the next five places in order. The women showed a greater preference or dislike for one color or form than the men, but no noticeable differences appear in the results on this account. The women were also better in discrimination of color, as several men complained that the purple and blue were hard to distinguish, but no woman made such a remark. Some of the latter did not like the gray, which was of a rather flat tone, especially as compared with the red and green.

COMMENTS AND SUBJECTIVE ATTITUDES

We mention the attitudes of the subjects as expressed by themselves during the experiment and noticed by the experimenter (R. W. H.).

First, as to the form of the experiment: The women differentiated between colors better than the men. They also formed preferences, which were evidenced by saying "Good," "Too bad," and similar remarks when they were told that a certain color was excluded from the next pack. They were not confused by the similarity of purple and blue, as quite a few of the men were.

Confusion was present in practically all subjects at one time or another; in fact in almost every single sorting. Some subjects remained in a muddled state of mind during the rest of the sorting of that pack, while to others the slight delay caused by confusion served as an added stimulus to increased effort.

The question arises as to whether the confusions occurred

more frequently in sorting the packs which involved more choices or fewer choices. No record was kept; probably it would be difficult to keep very accurately, but the impression is that the packs involving two and six choices created more confusion than the others, and for opposite reasons. Six packs present a multiplicity of choices; two packs tend to guessing ahead. In the latter case the subject tends either to alternate or to keep dealing to one box. After about four or five of a kind in succession one expects several of the others, and when it does not turn out this way there is confusion.

In a few cases one form was confused with another, although there was less complaint about this than about the colors. The diamond and the triangle were mixed several times, while in one or two instances the diamond and the square proved confusing. One subject did not at first comprehend the triangle when it landed upside down. A star might have been preferable to the triangle, but for the difficulties in painting. As the boxes were of different material than the cards, a few of the colors painted on their sides to mark them were somewhat different from the actual colors to be sorted, due to different amounts of absorption. The yellow in particular was rather flat. Several subjects complained of this—all women.

About two weeks after the experiment was given all subjects who could be located were asked which they would prefer to sort, color or form, and which number of suits. Five preferred color and five form. Of those preferring form, three had sorted it first and two did it as the second half of the experiment. Four out of five choosing color had sorted it second. Of the ten asked, six were men and four women. The men chose form four out of six, while the women expressed a three-out-of-four preference for color. As to number of discriminations preferred, three chose two; three chose three; one each preferred four, five, and six. One subject could not express any preference.

Most of the subjects talked or hummed at times, or even more or less continuously during the sortings, which seems to indicate that the most concentrated effort was not necessary.

SUMMARY

1. A new routine for the card-sorting experiment is outlined where sorting proceeds by reaction to the previous card. Thus a card is not identified until it falls face up; the sorting movement is simplified; vision and attention are better controlled and the packs used remain well shuffled.

2. Two series of sorting decks of five each, one series for form and one for color, are described. Each deck contains 60 cards (blank commercial, spotted only at the center) but in the different decks the number of suits varies from two to six.

3. From results with 20 adult subjects, largely psychology majors, who after a brief amount of practice sorted each of the 10 decks twice in reverse order, we conclude that there is practically no difference in speed between sorting color and sorting form. The scores taken in any way are so near that the limit of probable error of each will cover the other. In every case, however, color has whatever slight advantage appears.

4. Sorting is consistently faster, the smaller the number of suits used in the deck, with due allowance being made for the distance from the trays. Learning, of course, complicates the picture, but the extreme difference between 2 and 6 suits appears to amount to less than 25 per cent.

5. The difference between subjects is cut down as the test progresses. There is a larger standard deviation for the practice or trial sorting and the first one or two recorded trials than for the last few sortings.

6. The parts of the test correlate very highly with each other. This indicates that skill in sorting for *color* is not much different from that for sorting *forms*, and that learning is about equal for the two kinds of discrimination and for the different numbers of card suits.

7. Women are noticeably faster than men in sorting for colors and forms. (This is based on results for 11 women and 9 men unselected for reaction time.) There was one man faster than any woman.

8. Uncorrected errors with this method of reacting to the previous card are so few as to be negligible.

FURTHER EXPERIMENTS ON THE ATTENTION VALUE OF SIZE AND REPETITION IN ADVERTISEMENTS

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I. ATTENTION "VALUE" OF SIZE

Previous experiments[1] on the attention value of size particularly in advertisements have never isolated the size factor alone. In Gale's experiments, size was complicated by familiarity of the words used, and in Adams's technique size and novelty were never isolated. The square root "law" as applied to attention in the sense of initial fixations is a transfer from the results of Hollingworth, Strong and others where use of the term attention has a very different connotation.

In the present experiment, an effort was made to avoid the factor of novelty which had been inherent in the previous one. The technique was very similar to the one previously described. Cards the size of the page used in *Collier's Magazine* were divided into six equal rectangles. In the middle of each rectangle was pasted one of the six colors, red, orange, yellow, green, blue, and violet. Each color consequently appeared on each card. But no two colors on the same card were the same size. The sizes were as follows: ½-, 1-, 1½-, 2-, 2½- and 3-inch squares. Hence, each size also appeared on each card. A total of 36 cards was used, so that each color and each size were used in each position on the page. Three variables consequently appear in the experiment, position, color, size. While

[1] Gale, Harloe. Psychological Studies from the University of Minnesota.

Adams, Henry F. Advertising and its Mental Laws, pp. 106–110.

these factors were present in each separate card, position and color might be supposed to be equalized when the series of 36 cards is considered as a whole, leaving size as the variant the effectiveness of which was to be determined.

The cards were placed in a holder and concealed from view by a hinged cover which, viewed from above and behind, turned in a clockwise direction. The duration of the exposure was about three-quarters of a second. After the exposure, the subjects were asked to record all of the colors they had seen in the order in which they had seen them. In the tabulations only the first colors seen were considered, such initial fixation being taken as the measure of attention "value." The sub-

TABLE 1

SIZE OF COLOR	NUMBER OF INITIAL FIXATIONS	PER CENT OF TOTAL
½	212	5.5
1	384	10.0
1½	608	15.6
2	641	16.7
2½	808	21.0
3	1,199	31.2
	3,852	100.0

jects numbered 107, of whom 54 were women and 53 men. The results of the men and the women are combined in the totals, for while differences in amount were discernible, the general tendencies discovered were highly similar.

Table 1 shows the total number of initial fixations out of a possible 3852 which fell upon each of the sizes used.

These results, when plotted in terms of a curve as in figure 1, show an S curve, a curve very different from the root curves previously obtained. However, if we limit for the moment our discussion to the relative sizes that have been heretofore used, the results are in moderate accord. The ratios for 1, 2, and 4 units of area are 1.00, 1.46 and 1.68 respectively which when poetic license is taken give approximately a root curve. When

the whole curve, with its additional points, is considered, the picture is very different. Then we encounter a "plateau" which may be taken as a sign of the interference of two or more diverse factors. Size is undoubtedly one of these, the other may be color, may be position, or may be both. At any rate,

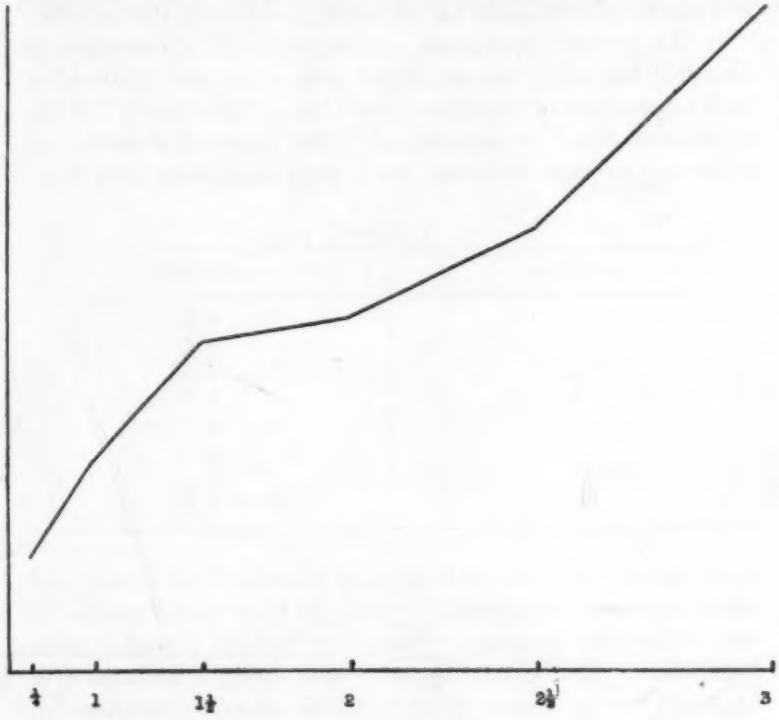

FIG. 1. ATTENTION VALUE OF SIZE

increase in size appears to be at first highly effective in attracting initial fixations, then follows a period of interference in which increase in size has its effectiveness inhibited by position and color, and finally there appears a sharp rise in the curve showing that increased size is again more potent than the inhibiting factors.

II. REPETITION AS AFFECTING MEMORY

Practically all of the experiments in advertising in which the effects of repetition have been determined have been made under certain minimum conditions. One, two, and four presentations of material have been employed and the memory test has been subsequent to the last appearance of the material.

In the present experiment, a maximum of 8 appearances of identical materials was employed and a test was made after each appearance of the material so that a "life history" of the tendencies could be ascertained. The material consisted of eight twelve-page dummies, each page containing four four-

TABLE 2

APPEARANCE	AVERAGE RECALL
1	2.6
2	4.3
3	4.6
4	5.1
5	4.8
6	5.6
7	5.6
8	6.2

letter words, so that each dummy contained 48 words. Of these, 12 were "Significant" words, for they were repeated in each of the eight dummies. The other 36 words in each dummy were fillers. Sometimes they were new words, sometimes they appeared for the second, third, or fourth times. The intention was to simulate the condition found in most mediums in which some firms always advertise, others do from time to time, and still others do very infrequently. Our problem was, what is the probable effectiveness of such consistent advertising? The answer given hitherto has been that the efficiency of repetition varies approximately as the cube root of the number of appearances.

Two forms of test were given. In the initial phases of the

experiment a recognition test was used. After the subject had read through the dummy he was given a mimeographed sheet containing the 48 words in the dummy and 48 new ones. In scoring a 5 represented absolute certainty that the word was in the dummy, 4 moderate certainty, 3 uncertainty, 2 moderate certainty that it was not, and 1 absolute certainty that it was

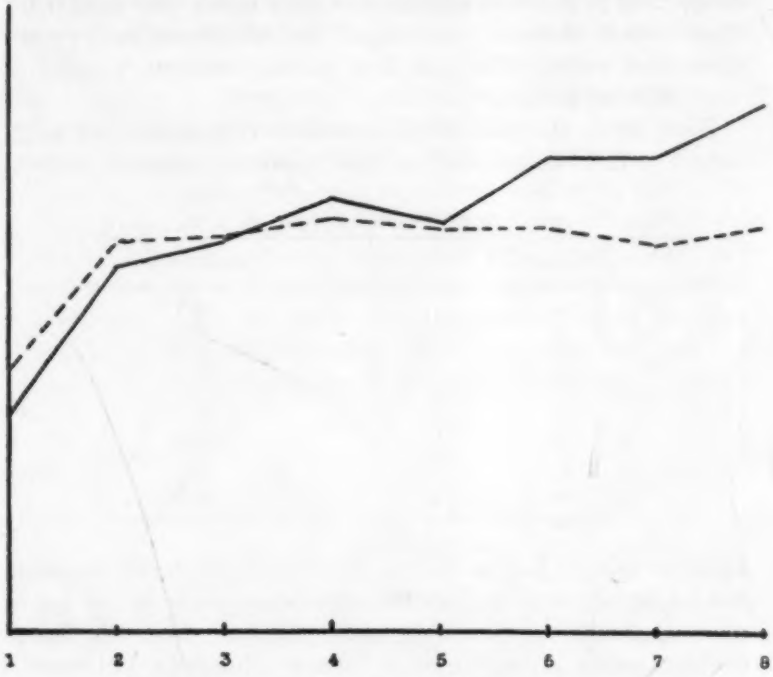

FIG. 2. MEMORY VALUE OF REPETITION
Solid line = recall; dotted line = recognition

not in the dummy. The introduction of the test after the reading of each dummy added extra repetitions which could not be avoided, but it also supplied at the same time additional inhibitions. Seventy-three subjects were used.

In the later phases of the experiment, a recall test was substituted for the recognition. This avoided repetitions except

in the case of recalled words and at the same time reduced the inhibitions coming from the indifferent words in the test list. In this part of the experiment 31 subjects were used.

By the recall method, the results shown in table 2 were obtained. This, when plotted, as in figure 2, again shows a tendency towards an S curve. The first four points covering the range used in previous experiments, give ratios very similar to those already obtained, and suggest the existence of an approximate root curve. The last four points, however, present a very different picture.

Here, as in the case of the attention experiment, we may expect to find, as indicated by the "plateau," opposed factors

TABLE 3

APPEARANCE	RECOGNITION
1	6.2
2	9.2
3	9.3
4	9.7
5	9.5
6	9.5
7	9.1
8	9.5

again at work. In this case they are probably repetition and the inhibitions coming from non-significant words in the dummies. Initially repetition is more effective, then inhibition becomes active, giving the curve the appearance of a root curve, and finally repetition again comes into its own triumphing over the inhibiting factors.

Table 3 gives the results for the recognition memory test. Here, as in the case of recall, there is an initial rise, followed by a plateau. But the third stage of the curve which shows repetition as being more effective than the inhibitions, is lacking. This, however, is exactly what we would expect, for in the recognition experiment a test list composed of 96 words followed the reading of each dummy. For the eight dummies,

this makes a total of 768 words in addition to these contained in the dummies. The effect of these must be an increase in the potency of the inhibitive factors. If a dozen or more repetitions had been made instead of only 8, it is probable that the third phase of the curve, indicating a further rise for repetition, would be found.

Our results show, when they are compared with the previous experiments a moderately high agreement, in so far as identical points on the curves are concerned. When however, the range of variables is increased to extend beyond the scope of the earlier work, an extremely significant difference appears. This difference, increased efficiency for both the attention value of size and the memory value of repetition, makes it evident that the square root and the cube root "laws" can be applied only for the situations covered when they were determined. Any extension of these "laws" past these points will lead to incorrect inferences. The points brought out in this paper, if substantiated by subsequent work, will demand a revision of many of the now accepted principles of the psychology of advertising.

A STUDY OF SELF-RATINGS BY CHILDREN

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In an attempt to measure and analyze character traits, the psychologist resorted first to the rating scale method. Ratings of others often proved to be faulty, due to two outstanding factors of error. First, there is a tendency to rate a person in terms of his most conspicuous character trait, and to be prejudiced either for or against him on this basis. Thorndike has given the descriptive term "halo" to this tendency. Secondly, unless the person is well known to the rater, there is a chance for error to arise, due to incomplete knowledge or one-sided information. In order to eliminate these difficulties, the psychologist then tried the method of self-rating, whereby a person rates himself, rather than being rated by another. The advantage of this method is, of course, that as a person knows himself better than any one else could ever know him, he should be the most competent judge of what traits he possesses. To offset this advantage, two disadvantages at once appear. Unless a person is able to introspect accurately, he is often entirely unconscious of some of the traits he possesses, especially the bad ones. Also, there is a tendency to over-estimate the presence of socially desirable traits, and to under-estimate the presence of socially undesirable ones.

Hollingworth, in his book, "Judging Human Character," takes up this problem from an experimental point of view (pp. 48–53). He says:

> In judging ourselves do we over-estimate or under-estimate? It may of course be suggested at once that our general knowledge of human nature tells us that individuals will over-estimate their good points and under-estimate their bad ones. But "general knowledge of human

nature" is always to be mistrusted until it is verified under controlled conditions. It may, for example, be true that such a general tendency is present, but that it is more conspicuous in some traits than in others.

In order to secure experimental data concerning this point, the following method was used:

Twenty-five persons agreed to rate themselves in nine different traits, by indicating at what point they stood in a group of twenty-five, when these were arranged in an order of merit for each trait. Thus a self-estimate of "1" in Neatness meant that the individual believed herself to be the neatest in the group of twenty-five, with all of whom she was

TABLE 1

Showing constant tendencies or bias in self-estimation

(Data secured from study of estimates of fifty people)

TRAIT	CONSTANT ERROR	NUMBER OVER-ESTIMATING THEMSELVES	NUMBER UNDER-ESTIMATING THEMSELVES
		per cent	*per cent*
Refinement	+6.3	80	20
Humor	+5.2	78	22
Intelligence	+3.0	68	32
Sociability	+2.2	68	32
Neatness	+1.8	50	50
Beauty	+0.2	50	50
Conceit	−1.7	48	52
Snobbishness	−2.0	36	64
Vulgarity	−4.2	34	66

personally acquainted. . . . . All the members of this experimental group constructed such a serial arrangement of the group for each trait, each placing herself at that point in the series at which she judged herself to belong. The record was made in an apparently anonymous way, but unknown to the members of the group, accurate record had been kept of their judgments, by a secret method. Each person thus not only judged herself, but was in turn judged by twenty-four of her acquaintances. If we take the consensus of opinion (combined arrangements) of the acquaintances as fairly representing the impression made by the individual on the world, this gives us a measure of her manifest character in the traits considered. We can therefore determine the accuracy of the self-estimates by comparing them with the con-

sensus of acquaintances. . . . . Representing a displacement toward the upper part of the scale and toward the lower part of it by (+) and (−), respectively, and averaging algebraically the tendencies for all the individuals, the data are shown in table 1, along with certain other information.

In general our expectations from "knowledge of human nature" are realized. Traits which we should on the whole characterize as "admirable" traits are over-estimated; traits ordinarily classed as "reprehensible," on the other hand, are under-estimated. . . . . But this is not all of the story. Some traits, such as Neatness, Beauty, and Conceit may readily be classified as "admirable" or "reprehensible," yet these traits show no considerable constant errors of self-estimation in either direction. And the constant errors for some of the admirable and for some of the reprehensible traits are fully twice as great as those for other traits in the same general group. The very least that we can say, on the basis of the results, is that in discounting an individual's opinion of himself or herself, no "blanket allowance" can be made for all traits indiscriminately. The errors of self-prejudice are greater in some traits than in others. It is possible that the degree of constant error measures the degree of desirability or undesirability attributed by the individual to the trait in question. The order in which the traits occur in our table would on this basis indicate their order of desirability on the part of our subjects, and the size of the error would reflect the degree of desirability or undesirability. Not having included those traits, we cannot infer that "Cleanliness is next to Godliness," but it may be safe to judge that Humor is next to Refinement, in the evaluation of our judges. The fact that Sociability and Snobbishness, which are in a sense opposite traits, show opposite constant errors of almost equal amount lends a certain probability to this conjecture.

The purpose of this study was to apply the rating scale method to children, to see if they showed the same tendency to under-estimate the presence of undesirable traits, as did college students. More specifically, the problem might be stated thus: when a choice is given of two descriptive adjectives, one relating to a desirable, and the other to an undesirable character trait, how often will children choose the undesirable one as being descriptive of them? Problems of less importance which arose in connection with this study were what age and sex differences, if any, existed, and, of the undesirable traits marked, was there a tendency to under-estimate the presence of these according to the degree of their undesirability?

The children used as subjects for this experiment were 423 white and negro children of both sexes from grades 7 and 8 of Public School No. 5 Manhattan, New York City. Table 2 contains information concerning the distribution, age and I.Q. scores of these children. An examination of this table will show that an almost equal number of white and negro children were used. In the former group, there were 219 children, and in the latter, 204. The average age of the white group was

TABLE 2

Distribution of subjects

	BOYS	GIRLS	COMBINED
White	110	109	219
Negro	101	103	204
Combined	211	212	423

Age of subjects

	AVERAGE	σ	P.E. AV.
White	13.22	1.03	0.07
Negro	13.76	1.04	0.07

I. Q. Scores of subjects

	AVERAGE	σ	P.E. AV.
White	107.45	18.85	1.21
Negro	106.95	18.80	1.26

13.22 years, with a σ of 1.03, and of the negro group, 13.76 years, with a σ of 1.04. The I.Q. scores showed a similar agreement between the two racial groups. The average I.Q. score for the white group was 107.45 with a σ of 18.85, and for the negro group, 106.95, with a σ of 18.80. The high I.Q. scores for both groups can be explained by the fact that an experiment of this sort required a certain degree of intelligence, and it was therefore necessary to take children of the higher sections of the two school grades.

The first test of the Downey Group Will Temperament Test[1] was selected as the material for this experiment. For the benefit of the readers who are not readily familiar with this test, a copy of it will be given here.

1. Draw a line under the word in each pair which more nearly describes you. Take the pairs in order. Don't skip any. Speed doesn't count.

1. Careful	Careless
2. Daring	Cautious
3. Ambitious	Unambitious
4. Selfish	Unselfish
5. Punctual	Tardy
6. Bad-Tempered	Sweet-Tempered
7. Accurate	Inaccurate
8. Industrious	Lazy
9. Vain	Modest
10. Constant	Changeable
11. Indifferent	Enthusiastic
12. Firm	Yielding
13. Trustful	Distrustful
14. Cowardly	Brave
15. Clever	Stupid
16. Good Memory	Bad Memory
17. Self-Distrustful	Self-Confident
18. Hasty	Deliberate
19. Observant	Unobservant
20. Sociable	Unsociable
21. Orderly	Disorderly
22. Gloomy	Cheerful
23. Patient	Impatient
24. Quick in Thought	Slow in Thought
25. Quick in Movement	Slow in Movement
26. Ready to Forgive	Holds a Grudge
27. Fond of a Fight	Avoids a Fight
28. Extravagant	Saves Money
29. Humble	Proud
30. Generous	Stingy

In giving the test, the experimenter told each child to check one word in each pair that more nearly described him. No

[1] Downey Group Will-Temperament Test, by June E. Downey, published by World Book Company, Yonkers-on-Hudson, New York.

time limit was set, and the examiner asked each child to wait for the rest of the group before marking the words. She explained the meanings of the words, one pair at a time, before they were marked. This was for the benefit of those members of the group who were unfamiliar with the words, or uncertain about their exact meaning. With two exceptions, each child followed the instructions to the letter, and these two cases were discarded.

Five Graduate students in Psychology at Columbia University were then asked to study carefully the list of 30 pairs of words given in the Downey Test, and after careful deliberation, to mark the word in each pair which the child, because of home or school training, would be most apt to consider undesirable. The words on which all five members did not agree were discussed by the group, and a final decision reached. The following list was agreed upon, and was used as a standard for the experimental work done on these tests: Careless, Daring, Unambitious, Selfish, Tardy, Bad Tempered, Inaccurate, Lazy, Vain, Changeable, Indifferent, Yielding, Distrustful, Cowardly, Stupid, Bad Memory, Self-Distrustful, Hasty, Unobservant, Unsociable, Disorderly, Gloomy, Impatient, Slow in Thought, Slow in Movement, Holds a Grudge, Fond of a Fight, Extravagent, Proud, Stingy.

After this list was made up, the group was then asked to subdivide it into three divisions; the ten first to go into the first division, the ten medium in undesirability to go in the second, and the remaining ten in the third. The same procedure was used as before, and the groups decided upon were as follows: *Most Undesirable*, Selfish, Bad Tempered, Lazy, Cowardly, Stupid, Unsociable, Disorderly, Stingy, Extravagent, Holds a Grudge; *Mediumly Undesirable*, Careless, Unambitious, Tardy, Vain, Bad Memory, Gloomy, Slow in Thought, Slow in Movement, Impatient, Fond of a Fight; *Least Undesirable*, Daring, Inaccurate, Changeable, Indifferent, Yielding, Distrustful, Self-Distrustful, Hasty, Unobservant, Proud.

Table 3 shows the results for the entire group taken as a whole, without reference to age or race differences. From this

it may be seen that of the 12,690 responses made, only 763 or 6 per cent of these were undesirable. The remaining 11,927, or 94 per cent, were responses which indicated the presence of socially desirable traits. Each of the 30 undesirable responses was then studied individually to determine the percentage of children rating themselves as possessing it. An examination of these results will show that the traits most often marked were; Proud, Daring, Bad Tempered, Careless, Fond of a Fight, Hasty and Changeable. It is questionable to the writer if children, especially boys, would not admire such traits rather than look upon them as socially undesirable. This is particularly true of such traits as Proud, Daring and Fond of a Fight. The traits least often marked were: Stingy, Distrustful, Cowardly and Stupid. These, it would seem, are obviously the most undesirable of the group.

The children were then divided into two racial groups, white and negro, with the purpose of experimentally testing out the general assumption that negroes tend to over-estimate themselves more than do whites, as a form of rationalization. Table 4 gives these results. The percentage of undesirable responses made by the white group was 7.3, and by the negro, 4.6—a difference of 2.7 per cent. This difference, however, is small enough to be of little significance. The undesirable traits most often marked by the white group were: Proud, Bad Tempered, Changeable, Fond of a Fight, and Impatient; by the negro, Proud, Daring, Hasty and Bad Tempered. Those traits which were least often chosen by the white group were, Stingy, Distrustful, Cowardly, Stupid and Unobservant; by the Negro, Stingy, Cowardly, Stupid, Lazy and Unambitious. These results show a great overlapping of the two groups, and tend to confirm the statement made above that the difference between the two groups was small enough to be of little significance.

In order to determine if any sex differences existed, the children were then subdivided into groups of white and negro boys, and white and negro girls, and combined racial groups of boys and girls. The results of this treatment of the material are given in table 5. The percentage of undesirable responses made

TABLE 3

Total results

Total responses	12,690
Undesirable responses	763
Percentage of undesirable responses	6
Percentage of frequency of choice of undesirable responses:	
Careless	11
Daring	15
Unambitious	2
Selfish	4
Tardy	3
Bad Tempered	13
Inaccurate	6
Lazy	1.6
Vain	5
Changeable	11
Indifferent	2
Yielding	4
Distrustful	1.4
Cowardly	1.4
Stupid	1.4
Bad Memory	5
Self-Distrustful	2.8
Hasty	11
Unobservant	2.6
Unsociable	3.3
Disorderly	3.5
Gloomy	3.3
Impatient	9
Slow in Thought	7
Slow in Movement	3.3
Holds a Grudge	3.1
Fond of Fight	11
Extravagant	6
Proud	26
Stingy	0

by the boys was slightly higher than that made by the girls of the white and negro groups, and also of the combined groups. The differences were 1.4 per cent for the white, and 2 per cent for

TABLE 4

Race comparisons

	WHITE	NEGRO
Total responses	6,570	6,120
Undesirable responses	482	281
Percentage of undesirable responses	7.3	4.6
Percentage of frequency of choice of undesirable responses:		
Careless	16	6
Daring	11	18.5
Unambitious	3	1
Selfish	6	1.5
Tardy	4	2.5
Bad Tempered	15	10.8
Inaccurate	0.9	2.4
Lazy	3	0
Vain	7	3.4
Changeable	13	9
Indifferent	3	1.5
Yielding	6	2.5
Distrustful	1.9	1
Cowardly	2.8	0
Stupid	2.8	0
Bad Memory	8	2.5
Self-Distrustful	3.2	2.5
Hasty	11.4	11.3
Unobservant	2.8	2.5
Unsociable	4	2.5
Disorderly	4.6	2.5
Gloomy	4	2.5
Impatient	11.9	5.9
Slow in Thought	10	3.9
Slow in Movement	3	3.4
Holds a Grudge	3.7	2.5
Fond of Fight	12.6	9.8
Extravagant	9	2.5
Proud	28.7	23.5
Stingy	0	0

TABLE 5

Sex comparisons

	WHITE		NEGRO		COMBINED	
	Boys	Girls	Boys	Girls	Boys	Girls
Total responses	3,300	3,270	3,030	3,090	6,330	6,360
Undesirable responses	266	216	169	112	435	328
Percentage of undesirable responses	8	6.6	5.6	3.6	6.9	5.1
Percentage of frequency of choice of undesirable responses:						
Careless	12.7	19.2	3.9	8.7	8.5	14
Daring	18.1	4.6	28.8	7.7	23.7	6.1
Unambitious	4.5	1.9	1.9	0	3.3	.9
Selfish	2.7	9.2	0.9	1.9	1.9	5.6
Tardy	6.3	1.8	3.9	0.9	5.2	1.8
Bad Tempered	15.4	14.7	9.9	11.6	12.8	13.2
Inaccurate	7.3	11	1.9	2.9	4.7	7.7
Lazy	2.7	3.7	0	0	1.4	1.9
Vain	5.4	7.3	4.9	1.9	5.2	4.7
Changeable	12.7	13.8	11.8	5.8	12.3	9.9
Indifferent	3.6	1.8	2.9	0	3.2	.9
Yielding	4.5	6.4	0.9	3.9	2.8	5.2
Distrustful	1.8	1.8	1.9	0	1.9	.9
Cowardly	1.8	3.7	0	0	0.9	1.9
Stupid	1.8	3.7	0	0	0.9	1.9
Bad Memory	9.1	6.4	2.9	1.9	6.1	4.2
Self-Distrustful	2.7	3.7	2.9	1.9	2.8	2.8
Hasty	13.6	9.1	10.9	11.6	12.3	10.4
Unobservant	3.6	1.8	1.9	2.9	2.8	2.3
Unsociable	4.5	3.7	1.9	2.9	3.3	3.3
Disorderly	5.4	3.7	1.9	1.9	4.1	2.8
Gloomy	2.7	5.5	1.9	2.9	2.3	4.3
Impatient	14.5	9.2	6.9	4.8	10.9	7.1
Slow in Thought	10.9	9.2	1.9	4.8	7.1	7.0
Slow in Movement	4.5	1.8	3.9	2.9	4.2	2.3
Holds a Grudge	2.7	4.6	1.9	1.9	2.9	3.3
Fond of Fight	16.3	8.2	13.8	5.8	15.1	7.1
Extravagant	10.9	7.3	1.9	1.9	7.1	4.7
Proud	38.2	19.2	32.6	14.5	35.5	17.0
Stingy	0	0	0	0	0	0

the negro, and 1.8 per cent for the combined groups, each in favor of the boys. This difference, of course, is too slight to be of any significant value. A study of the undesirable traits most often marked reveals the following results: White boys, Proud, Daring, Fond of a Fight and Bad Tempered; White girls, Proud, Careless, Bad Tempered, and Inaccurate; Negro boys, Proud, Daring, Fond of a Fight, and Changeable; Negro girls, Proud, Hasty, Bad Tempered, and Tardy; Combined Group, Boys, Proud, Daring, Fond of a Fight and Bad Tempered; Combined Group, Girls, Proud, Careless, Bad Tempered and Hasty. The traits least often marked were: White boys, Stingy, Cowardly and Distrustful; White girls, Stingy, Slow in Movement, Unobservant and Distrustful; Negro boys, Stingy, Stupid,

TABLE 6

Comparison of traits grouped according to degree of social undesirability

	10 MOST UNDESIRABLE	10 MEDIUMLY UNDESIRABLE	10 LEAST UNDESIRABLE
Total responses	4,230	4,230	4,230
Total undesirable responses	157	257	349
Percentage of undesirable responses	3.8	6.1	8.2

Cowardly and Lazy; Negro girls, Stingy, Stupid, Lazy and Cowardly; Combined Group, Boys, Stingy, Lazy, Stupid and Cowardly; Combined Group, Girls, Stingy, Distrustful, and Unambitious. These results, as was the case in the race comparisons, show that the sex differences are so slight as to be negligible, and that there is a decided overlapping in the case of each comparison made on the basis of division according to sex.

A study was then made of the three subdivisions of the undesirable traits into the classes; Most Undesirable, Mediumly Undesirable, and Least Undesirable. The results are shown in table 6. The number of Most Undesirable responses was 157.

of Mediumly Undesirable, 257, and of Least Undesirable, 349, or 3.8, 6.1 and 8.2 respectively. This difference, though a slight one, gives positive evidence that there is not only a tendency to avoid marking sociably undesirable traits, but the more sociably undesirable they are, the greater is the tendency to avoid marking them.

SUMMARY AND CONCLUSIONS

The facts presented in the preceding paragraphs seem to justify the following conclusions:

1. Of the 12,690 responses made by the group of 423 children, only 763 or 6 per cent of these were ones relating to socially undesirable character traits. The traits, Proud, Daring and Bad Tempered were most often chosen of this group of 763, and those least often chosen were Stingy, Distrustful and Cowardly.

2. A comparison of the two racial groups, white and negro, revealed the fact that 7.3 per cent of the responses made by the white group were of the socially undesirable type, and 4.6 per cent of the negro were of this kind. The undesirable traits marked by the white children were very similar to those marked by the negroes.

3. Sex comparisons brought out the fact that boys on the whole tended to mark more of the socially undesirable traits than did the girls. This was true of the white, negro and combined groups.

4. When the thirty undesirable responses were sub-divided into three groups of ten each, on the basis of the degree of undesirability, it was found that the percentage of the most undesirable traits was less than that of the mediumly undesirable, and that in turn, less than the percentage of least undesirable.

If this group of children can be considered representative of children as a whole, these results would suggest that the use of self-rating scales for children is of uncertain value. There seems to be a decided tendency for children to over-estimate the presence of traits which are socially desirable, and to under-estimate the presence of traits which are undesirable. This is

done to an even greater extent than in the case of college students, as reported by Hollingworth. Therefore, if an accurate representation of the character of the child is desired, it would be better to obtain it through the use of some standard character or personality test, or through judgments of individuals who are well enough acquainted with him, and free enough from personal prejudice, to give a fair and thorough rating.

SOME CRITICAL COMMENTS ON CERTAIN PREVAILING CONCEPTS AND METHODS USED IN MENTAL TESTING

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The several criticisms which are offered in this paper are not so much criticisms of mental testing as an applied or practical science as they are criticisms of mental testing as a pure science. Several of the criticisms could be obviated if the mental tester in the practical field would be more careful to indicate that his concepts are of a rough, practical nature in many cases. We wish to point out several conditions which, in the writer's opinion, are in much need of clarification and definition.

"VALIDITY" OF A TEST

The term "test validity" has now come to signify the degree to which any test actually tests that which it was designed to test, and nothing else. Thus if a test is designed to test ability to form associations or learn, then the question at once arises whether the test really tests this capacity or ability and this alone. A "valid" intelligence test is one which tests intelligence as the maker of the test defined "intelligence." Now it is in the case of intelligence tests that we wish to offer a criticism. How has the intelligence test been judged valid or invalid? One, and often the chief, method used in testing the validity of an intelligence test appears to the writer to be particularly absurd. Having devised an intelligence test and having given it to several children, let us say, the author of the test at once rushes to the school or home. The teacher is asked to "estimate" the children's intelligence. Now if the teacher's estimate agrees with the results of the objective measuring device all is well and good.

The test is valid. If, on the other hand, the teacher's estimate and the test results do not agree then the test is declared "not valid." Likewise the parents and friends estimate each child's intelligence and the test is checked against these estimates.

Let us consider something of an analogy from the physical sciences. Let us suppose that the physicist has devised a yard-stick having a zero end of the scale and definite agreed-upon units. This stick is designed to measure spatial extents and the author of the test desires to measure the height of a school-boy whose name is John. He measures John's height carefully, finding it to be four feet and seven inches as measured in terms of his scale. But now our physicist grows doubtful. He asks three teachers to look closely at John as he stands before them and "estimate" his height. Each teacher estimates John's height to be about four feet and ten inches. Therefore the measuring stick is not valid! But, of course, all would agree that this last statement is mere nonsense.

The sooner the mental tester, who wishes to remain a scientific psychologist, forgets such practical criteria and turns to the laboratory of experimental psychology the sooner mental tests will reach their goal of being psychological tests. What the teacher, parent or friend thinks about the child's capacity or ability is of no concern to the psychologist as such. Beyond a doubt it is very desirable and often necessary that a test be devised which *correlates* highly with some "job" or practical criteria, such as scholastic success, athletic ability, and what not. But this desideratum is entirely of a practical nature. Any pure science psychology test-instrument is of *practical* value only to the extent that its results correlate very highly with the "job" or given practical situation. But all this should in no wise blind our eyes to the fact that out of the experimental laboratory must come our criteria whereby we test the validity of our psychological test.

"RELIABILITY" OF A TEST

If a test is given on two or more occasions to the same group of persons will the relative rankings or standings remain the

same or approximately the same? If so then we say that the test is reliable. If there is considerable displacement then we say that the test is unreliable. The term "reliability" is a statistical term of excellent use and unquestioned importance. However, one may get an entirely wrong impression of the merits of a test as a measuring instrument if one takes "reliability" in the above sense too literally and individually.

Now a human organism is a tremendously complicated, highly organized, and delicately balanced mechanism. Being such we would expect any man to be in a slightly changed condition from time to time. We would get the same test result or performance on two or more different occasions only if we had identical internal and external conditions on each occasion. Theoretically this is impossible, and practically it becomes a matter for serious consideration. By all methods of questioning and observing we judge that the man is the same today as he was yesterday but this may be far from the case. He may have matured somewhat; he may have changed his condition by some practice; he may not be quite so interested; his digestive tract may not be working well, and so forth. It is also difficult to control the external environment so that we will have an identical "set-up" and, even granting that the external conditions are identical on two different occasions, we cannot be at all sure that they will affect the man in the same way. In other words we would be very, very suspicious of any test that did not give variable results on different occasions.

Let us resort to another analogy taken from physics. Suppose that the physicist has devised an instrument for measuring temperature which he calls a Fahrenheit thermometer. He hangs this instrument on the side of his house in order to measure the temperature. He puts the thermometer outside on three different occasions during the day. Early in the morning the instrument registers twenty-four degrees. About noon it registers thirty-four degrees. In the evening it measures thirty degrees. Shall we say that the instrument is unreliable? Indeed it is very reliable and is "conscientiously," so to speak, measuring temperature. The fact of the matter is that the temperature conditions have changed.

It appears a little unfortunate to the writer that the term "reliability" is used in the statistical sense above mentioned with a reference to the test. When we say that the clock is reliable we mean that it is operating as the mechanism was designed to operate. It can be depended upon to run at the same rate from hour to hour. Now our test, as an objective measuring instrument, does remain the same. What changes is the man being tested. If the man varies a great deal then it is not a case of the test being unreliable but a case of the man being unreliable!

THE CONCEPT "INTELLIGENCE"

After reviewing various and sundry symposia on intelligence and its measurement the writer has reached two conclusions. First, most definitions are sociological rather than psychological. Second, most of the "definers" have apparently forgotten their training in experimental psychology and physiology.

To those sociologists and psychologists who have socialized psychology by some sleight of hand performance into a branch of sociology the first type of definition of intelligence may be inoffensive. To the average technical psychologist no social concept of intelligence can be considered as other than confusing. The mental tester, with his eye on practical applications and results, is likely to get far away from his technical laboratory data when he comes to define intelligence. This appears to have been the case.

If we devise a series of tests which "tap" or test the various higher central processes,—as ability to attend, to learn, to retain, to imagine, to reason, and to form abstract concepts,—we have an intelligence test which is psychological and which is a product of the psychology laboratory. Certain problems arise, of course, in the proper selection of test instruments needed to measure these various capacities and in the relative evaluations of each capacity. The first problem can only be settled by careful experimental study of "what " we are testing. Experimental psychology must always precede measurement and

testing. The second problem is a matter for mere arbitrary agreement among qualified psychologists. If it is agreed that in the total intelligence score the attention test is to have a value of one third or some other value, well and good. But in the end we will have an agreed-upon series of tests measuring an agreed-upon ability or group of abilities.

One may well pause to wonder whether the term "intelligence" as it is now (apparently) used is of any value to psychology. At present one's intelligence is merely a relative ranking on a battery of tests of the higher central processes. As such it represents a summation of the scores made upon the various component tests in the system. At best it is a sort of abstraction or "average" intellectual level. A psychograph, representing an individual's levels on the various tests, would be much more elucidating than an intelligence score which merely hides relative strength and weakness in the component abilities.

VARIOUS "KINDS" OF INTELLIGENCES

Again taking their cue from sociology and practical life some psychologists have suggested and introduced various "kinds" of intelligence. Thorndike has advocated these various species of intelligence as a logical outcome of his view that intelligence is but a bundle of specific and independent capacities. But it appears merely to add more confusion to an already sufficient confusion. If we speak of abstract, concrete, manual, and social intelligence then by virtue of the fact that we use intelligence throughout it is suggested that there is an intelligence common to all forms of activity. The thing then works very nicely over into Spearman's common factor view. Would it not clarify matters if we spoke of just one kind of intelligence, possessed in different degrees by different people, and proceed to define intelligence in agreed-upon psychological processes? It would not be necessary to know the ultimate nature of intelligence.

EFFICIENCY RIGHT NOW VERSUS "CAPACITY"

Any test measures what the subject can do right now, just as he is at this moment and under the external circumstances which are present. We may call this "present efficiency." But is it necessarily the man's "capacity?" Capacity should mean just what the term implies, namely, the person's ability under the optimum conditions for that organism. Capacity is apparently being used in two different senses, one of which should be entirely dropped or else very clearly defined. A person's true capacity could be measured only when that capacity has reached its maximum maturation and practice. The intensity of effort and interest must be maximal, to say nothing of the many other favorable external and internal conditions which would be pre-supposed. Capacity is, at best, an inferred thing and its inference is fraught with much chance for unfairness.

Perhaps it would be well to speak of measuring one's "efficiency" when we are seeking a person's demonstrable capacity as it reveals itself at the time of the testing. The term "efficiency" would then mean merely what the subject was able to do at that time. It would have no implications beyond this. The term "capacity" could then be used to signify what the person *might* do if his training, attitude, and physical condition, were *most favorable* for the most complete development of the given capacity or ability. A child reveals an intelligence quotient of, say, 100 on the Stanford Binet tests. Later on by systematic physical treatment, good food, or training the intelligence quotient has been raised to 135.[1] We may well say that the test did not get at capacity but merely efficiency at the time. To what extent we may infer capacity from efficiency, in the case of any test whatsoever, can be determined only by careful study.

[1] Just such a case has been recently reported by June E. Downey, Journal of Applied Psychology, Vol. XI, 1927, page 52. Other such cases have come to the writer's attention.

A STUDY OF THE RELIABILITY OF MENTAL TESTS AS USED IN OKLAHOMA CITY

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This study is given as a contribution to the available information concerning the reliability of mental tests when given by class room teachers.

In the Oklahoma City schools it has been the policy for the past four years to give each child entering the kindergarten or first grade a Binet Intelligence Test. These tests are given at about the time of entering the first grade. The plan in Oklahoma City has been to train all of the primary teachers in the giving of individual tests and to have each teacher responsible for testing the pupils of her own room. In the intermediate grades pupils are retested with the Otis Self-Administering Test of Mental Ability.

For a number of years the permanent record cards in the schools were not forwarded from school to school with the transfer of children but each school made out a new card for every entering child regardless of where he last attended. The data for this study were assembled from these duplicate permanent record cards which are now in the files of the Research Office.

The time intervening between the two tests ranged from one month to more than two years with an average interval of between eleven and twelve months.

It is true, of course, that in certain respects the children represented in this study are not a typical group. That is, they are drawn from the transient element of the city's population. The fact that the average IQ., derived from the 352 Binet tests, included in these figures was 100.3 and the average of the 168 IQ.'s derived from the Otis tests was 95.4 would seem to indicate that the group was not an inferior one. It is entirely possible, however, that other factors enter in to make mental tests less reliable with this type of children.

Table 1 gives the main facts relative to the reliability of the tests as shown by this study. An examination of this table will show that as used in Oklahoma City the Binet and Otis tests are equally reliable.

Table 2 is built to show the tendencies of the IQ. within the different portions of the total distribution. In this table only the Binet tests are considered. This table shows clearly two things; first, the reliability

of the test results increases rapidly as the scores approach the mean of the distribution; second, where an initial test gives an IQ. greater than

TABLE 1

	TESTS COMPARED			
	Binet and Binet	Binet and Otis	Otis and Otis	First and Second
Number of cases	144	64	52	260
Average difference in I.Q. between first and second tests (disregarding sign)	7.8	9.5	7.2	8.0
Coefficient of correlation between the two tests	0.74	0.72	0.78	0.74
P.E.$_r$	0.025	0.041	0.032	0.019
P.E. score*	5.1	5.8	4.5	5.1
Distribution according to number points difference in I.Q. Number of points difference:				
0–10	70.1%	62.5%	71.1%	67.7%
11–20	23.6%	31.3%	26.9%	26.9%
More than 20	6.3%	6.2%	2.0%	5.4%

* P.E. score $= 0.6745\sqrt{1-r}\times\sigma$.

TABLE 2

Tendencies of Binet Scores according to position of the initial test in the distribution

	SCORES ON INITIAL TEST								
	50 / 59	60 / 69	70 / 79	80 / 89	90 / 99	100 / 109	110 / 119	120 / 129	130 / 139
Number of cases	1	4	8	22	32	37	20	16	7
Average of first tests	59	64	73.6	84.7	94.8	104.4	112.9	122.4	131.7
Average of second tests	66	73.5	83.4	87.5	95.7	100.7	108.0	114.5	110.7
Difference in the two averages*	−7	−9.5	−9.8	−2.8	−0.9	+3.7	+4.9	+7.9	+21.0
Number of cases in which first test was higher than second	0	1	2	8	8	17	13	14	6
Number of cases in which first test was lower than second	1	3	5	11	16	12	6	0	1
Number of cases where scores were the same	0	0	1	3	8	8	1	2	0
Average disagreement between two tests	7	10	10.3	7.6	5.6	6.4	7.4	7.9	22.4

* + indicates average score of first tests was higher than average of second tests by amount indicated. − indicates average score of first tests was lower than average of second tests by amount indicated.

the mean the chances that this IQ. is too high are much greater than the chances that it is too low, while in those cases where the initial test gives the IQ. less than the mean the reverse is true. In both cases the

distance by which such scores are probably too high or too low increases with every increase in distance from the mean. It will be noted that in spite of the small number of cases in some of the outside columns there is no exception in this tendency to regress toward the mean anywhere in the table.

An examination of the two tables would seem to indicate that with a testing program organized such as Oklahoma City's little importance should be placed on the mental scores of the extremes of the distribution.

THE WILL-TEMPERAMENT OF INDIANS[1]

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In these modern days the term racial temperament has a very well established usage. We seem to see in the Chinaman one sort of temperament, in the Negro another and in the Indian another to say nothing of Italian temperament and Irish nature. It would be hard to shake the faith of latterday members of society in civilization away from such a belief. Somehow we have come to think just in this way and we have not asked ourselves the question if these temperaments are after all really racial, that is, native and not acquired. It is time that psychology were seeking to answer the question as to whether or not there are such things as racial temperaments.

Efforts have been made to study the temperament of the southern Negro scientifically (1), (2) and the device used for the purpose was either altogether or in part the Will-Temperament Test devised by Dr. Downey. The results of these studies, one by McFadden and Dashiell in North Carolina and the other by Sunne in New Orleans are indicative but not conclusive.

The writers recognize the inadequacy of all tests of personality used so far in making studies. This would include of course the group test devised by Dr. Downey which we are using to study Indian personality but we believe, with others, that it is the most promising attack of temperament yet made and that it bids fair to have a wide application as it is more and more perfected.

[1] Paper read before Section H, American Association for Advancement of Science, December 29, 1926, at Philadelphia, Pa.

PROBLEM

The problem here is:

1. To obtain, if possible, reliable measures of full-blood Indians for the various tests of the Group Will-Temperament Test.

TABLE 1

Scores Obtained in Group Will-Temperament Test by 101 Whites and 170 Full-Blood Indians

	TESTS												TOTAL SCORE
	A	B	C	D	E	F	G	H	I	J	K	L	
For white subjects													
Med	4.11	5.12	4.15	6.16	5.23	5.03	5.03	7.08	3.71	5.55	5.42	3.88	59.54
Q	2.05	3.25	1.82	2.17	1.12	2.65	2.47	2.69	1.53	1.91	2.66	2.13	5.39
$\frac{SD}{Med}$	0.37	0.60	0.34	0.30	0.20	0.48	0.44	0.48	0.28	0.17	0.48	0.39	0.99
For full-blood Indian subjects													
Med	2.83	3.08	4.59	3.19	5.31	2.98	3.44	6.10	6.85	5.90	1.95	9.68	55.86
Q	1.20	3.59	1.33	1.47	1.53	2.34	2.97	2.76	3.01	2.59	0.95	0.88	2.25
$\frac{SD}{Med}$	0.17	0.51	0.19	0.20	0.22	0.33	0.40	0.39	0.43	0.37	0.12	0.12	0.31
Overlaps*	22%	47%	56%	18%	58%	35%	46%	48%	72%	57%	16%	24%	34%

* Per cent of full-blood Indians attaining and exceeding the median of the Whites.

(A) Speed of Movement; (B) Freedom from Load; (C) Flexibility; (D) Speed of Decision; (E) Motor Impulsion; (F) Self-Confidence; (G) Non-Compliance; (H) Finality of Judgment; (I) Motor Inhibition; (J) Interest in Detail; (K) Coördination of Impulses; (L) Volitional Perseveration.

2. To compare these with similar measures of white individuals so as to ascertain if the groups behave differently when so tested.

SUBJECTS

There were two groups of subjects. One was a group of 101 White students in a High School of the City Schools of Denver. All but 5 of these were from the eleventh and twelfth grades and all but 7 were from seventeen years and on in age. Of these 7, one was fifteen years and the others sixteen years old. The

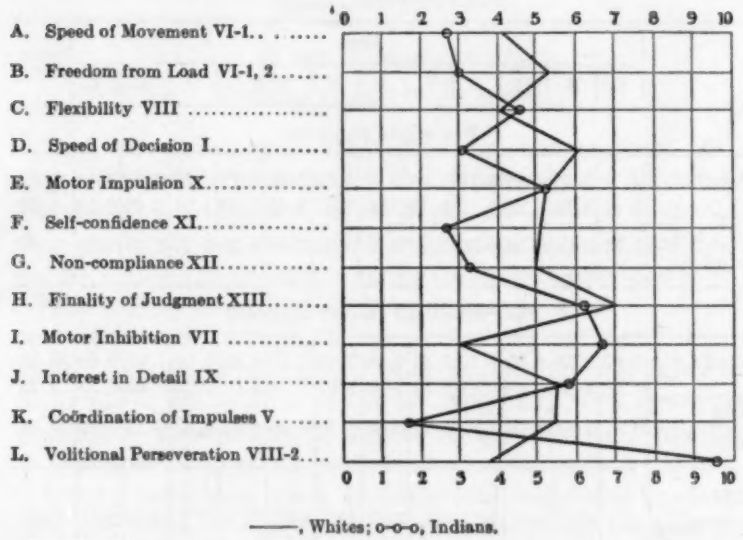
0 1 2 3 4 5 6 7 8 9 10
A. Speed of Movement VI-1.. . .....
B. Freedom from Load VI-1, 2.....
C. Flexibility VIII .....
D. Speed of Decision I.....
E. Motor Impulsion X.....
F. Self-confidence XI.....
G. Non-compliance XII.....
H. Finality of Judgment XIII.....
I. Motor Inhibition VII .....
J. Interest in Detail IX.....
K. Coördination of Impulses V.....
L. Volitional Perseveration VIII-2....
0 1 2 3 4 5 6 7 8 9 10
——, Whites; o-o-o, Indians.

FIG. 1. SHOWING WHITE AND INDIAN GROUP PROFILES

sexes were about equally divided there being 49 girls and 52 boys. The Indian group was composed of 170 full-blood Indians from the United States Indian Schools at Santa Fe and Albuquerque, New Mexico, and Rapid City, South Dakota. There were 85 boys and 85 girls. About half of the group were full-bloods from sedentary tribes being nearly altogether Pueblo Indians; the other half were from different nomadic tribes, mostly Navajos, Apaches and Sioux.

Administration and scoring

The accepted technique of administration of the group test was followed as closely as possible although it is realized that the technique is very difficult of execution. There was much practice by the experimenters in administering the test before the tests were given from which the data in table 1 were obtained. In scoring the tests the writers had some valuable assistance from the author of the tests for which they make acknowledgment. Regardless of these safeguards it is felt that variations found in these results may be partly due to variations in technique and scoring.

HANDLING THE DATA

In table 1 will be found the Medians and Quartiles of the 101 White subjects and of the 170 full-blood Indian subjects for each of the separate test items and for the total score. There will be found also measures of overlapping of the Indian measures on the white medians. Figure 1 gives the group profiles of the two racial groups.

INTERPRETATION

In the first place it will be seen from examining the medians of both racial groups and the profiles that there are points of similarity as well as difference; this is true on a basis of mere medians. But it will be noted that in some of the tests in both racial groups there is high variability and that therefore such medians are somewhat unreliable. This is true in eight of the tests for the white group and six of the tests for the Indians.

If one takes into consideration the overlapping of the Indians on white medians it will be found that the racial differences indicated by the medians in tests for Speed of Movement, Speed of Decision, Motor Inhibition, Coördination of Impulses and Volitional Perseveration indicate real differences as found between the two racial groups.

The overlapping for total score also indicates a tendency toward a real difference in that respect. That is to say, the

test indicates that the Whites are somewhat more speedy than the full-blood Indians in so far as the test indicates what it claims to test. They are just the same in flexibility but much more inclined to make quick decision than are the Indians. In motor impulsion the two racial groups are just about the same but the Whites show a greater amount of self-confidence than do the Indians. In non-compliance the results for the two groups are not very conclusive though the Whites are slightly stronger than the Indians it would appear upon comparing mere medians. The same may be said of finality of judgment although there is more similarity in the two group measures and the results appear more trustworthy, i.e., both groups appear rather strong in this respect. In motor inhibition the Indians certainly have the better of the Whites though they are slightly more variable. In fact the test indicates that this is a rather strong trait in the Indian group and the weakest trait for the Whites. In interest in detail the racial groups are again rather similar though the Whites are less variable. There is a striking weakness in coördination of impulses in the Indians as here measured. In this respect the Whites are (according to the author of the tests) just about normal. The difference seems to be genuine as measured. On the other hand the Indians attain a very high score in volitional perseveration and the variability is excessive under the circumstances whereas the score of the Whites is much lower and their variability is high. If we may take the total score as indicating strength of personality the Whites would appear to have stronger personalities than the Indians.

COMPARISON WITH NEGROES

Unfortunately the tests given to these Indians were not the same as those given by the investigators mentioned above but we may make a rough comparison. MacFadden and Dashiell conclude that the Negroes tested by them were slower than their White group and in this respect the findings for the Indians are similar in that they are slower than the Whites. They also found the Negroes to be quicker in the matter of speed of de-

cision than the Whites and we find the Indians slower than Whites. These investigators found the Negroes more self-confident but we find the Indians less so than the Whites. The Negroes were stronger in motor impulsion than Whites but the Indians are here found to be similar as measured. The Indians and Negroes seem to be slightly similar in being weak in non-compliance as compared with Whites. The Negroes are weaker in motor inhibition than the White group with which they were compared but here the Indians excel the Whites. Both the Negroes and these Indians proved weaker in coördination of impulses than the white groups with which they were compared and in volitional perseveration the Indians excel Whites while the Negroes fall below them in this respect.

The last finding of excellence in volitional perservation is supported by a finding by Garth (4) in his study of White and Indian and Negro work curves where the Indians held out better in a continuous task in addition than either Whites or Negroes although the Indians were nomadic Indians. His findings for sedentary Indians showed them as not excelling in the work curve test (5).

SUMMARY

When Indians are tested with the Group Will-Temperament Test and the results are compared with results from testing Whites of similar age we find:

1. The comparison of the total score indicates that Whites possess stronger personalities than Indians as here measured.

2. While the measures of various traits in both racial groups show great variability those showing least variability are: For Indians, Speed of Movement, Flexibility, Speed of Decision, Motor Impulsion, Coördination of Impulses, and Volitional Perseveration; for Whites, Flexibility, Motor Impulsion, Motor Inhibition, and Interest in Detail.

3. The greatest differences between the two racial groups as indicated by measures of overlapping are to be found in Speed of Movement, Speed of Decision, Self-confidence, Coördination of Impulses, Volitional Perseveration and Motor Inhibition.

4. Interpreted the above means that the Whites are more speedy in the test than are the Indians, they are quicker in making decisions, they are rather more self-confident, they have less motor inhibition, better coördination of impulses and are poorer in volitional perseveration.

5. The greatest differences as found here between the races are in speed of movement, speed of decision, coördination of impulses and perseveration. In only the last of these does the Indian excel.

6. It is rather dangerous to venture any conclusion with reference to comparison of Negro and Indian Temperament but it would appear that Indians are less speedy in decision than are the Negroes and they appear to be more given to motor inhibition than the Negroes.

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(3) Freeman, F. N.: Mental Tests, 1926, 191–303.

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THE FOURTH INTERNATIONAL CONGRESS OF PSYCHOTECHNIQUE

PORTIA HOLMAN

Official Interpreter and Assistant to Dr. Lahy

Between the 10th and 14th of October, 1927, the fourth International Conference of Psychotechnique was held at the Institute of Intellectual Coöperation of the League of Nations in Paris. This society was founded in 1920 by Professor Claparède (Geneva) with the aim of uniting at conferences and by other means all those whose work and interests are in psychotechnique.

Its conditions of membership are very elastic. There are no fees and no articles to subscribe to; its chief purpose being to unite as many psychotechnicians as possible so as to be truly international and representative.

The Paris Conference was the first since 1922 and by the great increase in attendance as in other ways reflected the development that has taken place in this science in the last five years.

The wishes of its founders that a large body of scientists representative of a large number of nationalities should be brought together were fully realised. In particular it was the first time delegates from the United States of America or from the United Soviet Republic of Russia had been present. Consequently it was the first meeting which can be considered as truly representative of the trend of psychotechnical development in all parts of the world.

If that trend may really be judged by the views of the representatives at this conference, the meeting had a special significance in marking the stage at which the science of psychotechnique has now arrived.

As Mr. Lahy expressed it in his report the conference appeared as a "public and international examination of conscience."

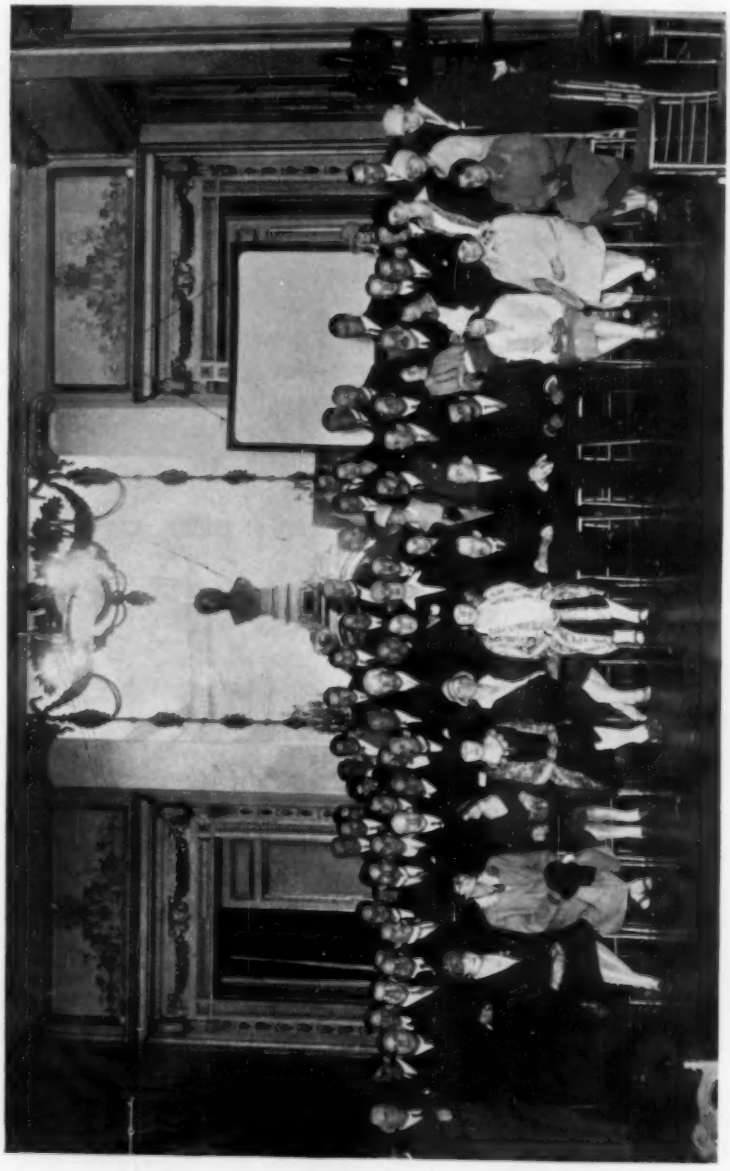
This important meeting seems to have been in accord with a general desire on the part of psychotechnicians in all countries to get into closer touch with one another, to find out more clearly what is going on elsewhere and to create harmonious coöperation between the researches and investigations of different countries.

There was a very general feeling that the relative isolation of psychotechnicians in any one country and their ignorance of what was taking place elsewhere had led to too great a multiplication of effort in the same field and a loss of valuable comparisons because in different places investigators had worked on the same material by similar but not strictly identical methods. Nevertheless one of the most striking conclusions to be drawn from the conference was that, notwithstanding the almost complete lack of coöperation in the past, workers in different countries had arrived independently at the same methods and had the same ideas as to the broad and general lines of the science.

At the conference there was a definite unity given by the universal interest in general questions of method, control and interpretation. No matter what topic was being discussed almost invariably it was to this aspect of it that both the papers read and the subsequent discussion were directed. Indeed, the whole question of method and of the place of mathematics and statistics in psychotechnique had been given special prominence in the program. From this discussion two outstanding problems arose: (1) the use and reliability of the correlation coefficient; (2) the question of the constancy of subjects, i.e., the reliability of a single test as the measure of the subject's capacity.

This second question which clearly affects the whole procedure of psychotechnical investigations aroused the demand for a "gigantic international experiment" as one speaker well put it.

Among the discussions of particular subjects one might stress the question of tests of character as being of special interest to the conference. There was a general agreement that for purposes of vocational guidance and selection existing tests are far from adequate. It was felt to be most urgent that attention should be directed to the problem of supplementing them both by those of moral qualities and by tests of the higher mental qualities, for example, organizing ability.



HOSTESSES AND SOME OF THE GUESTS AT THE AFTERNOON TEA

The headings under which discussion took place were: Principles and Method of Psychotechnique, The Educability and Constancy of Subjects; The General Question of Tests, The Problems of Training (of special skill), The Relation of Psychotechnique to Education, The Relation of Psychotechnique to Psychiatry, The Question of Selection with Special Reference to Transport Services.[1]

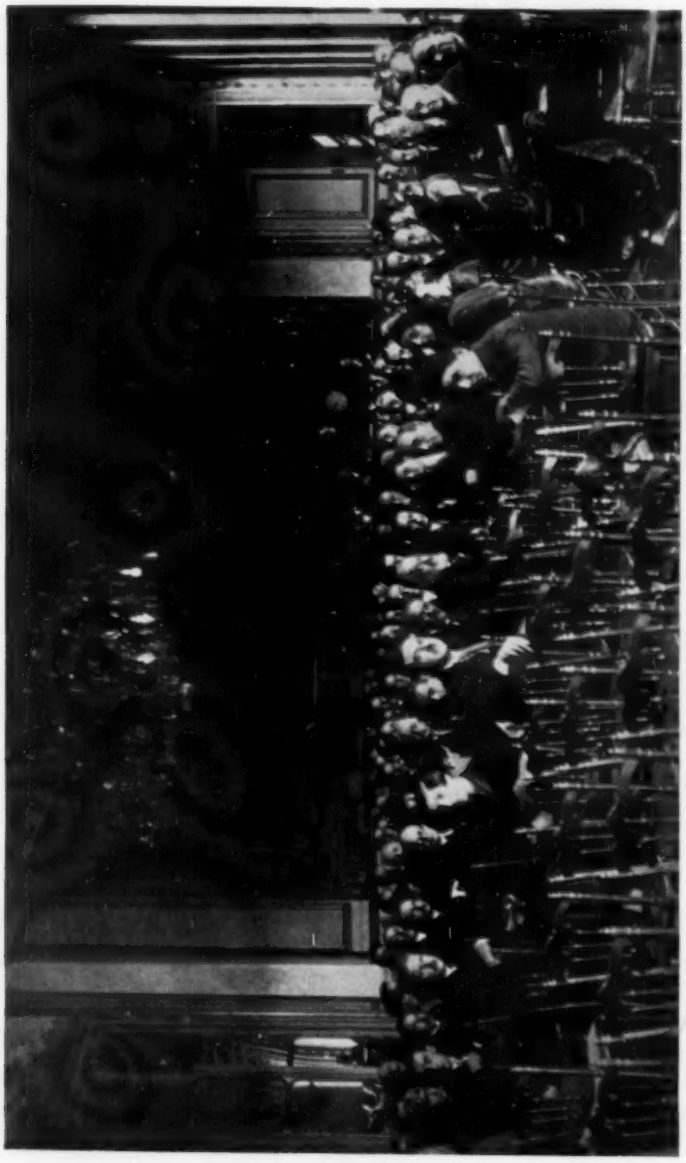
The one unsatisfactory feature of the conference was its brevity. It is, of course, of the nature of a conference that it should last only four or five days but it was particularly regrettable in this instance because the number of papers was exceptionally large. The problems arising out of them might profitably have been discussed for a year.

The number of papers was so great that many will be communicated for the first time in the proceedings of the conference to be published shortly. Of those which were read time permitted the discussion only of a small number and frequently with a time limit.

Differences in languages and the lack of time for complete translations presented another obstacle to exchanges of views. At least there was no lack of private discussion between the crowded sessions and, as we have noted above, in spite of material difficulties the general trends of ideas were very clearly manifested.

Most of the members present were in agreement with the views put forward by Mr. Wilson (London) in a special paper dealing with the organization of the association. He argued that the association should be more than a mere agency for holding occasional conferences and that as far as possible continuous investigations of an international character should go on in the inevitably lengthy intervals between conferences. In particular the association might usefully perform the function of codifying and bringing together an

[1] The papers on this subject were read at a special meeting of the psychotechnical laboratory of the Société de Transports en Commun de la Région Parisienne in which members were able to supplement discussion by an inspection of the practice in this laboratory.



THE FIRST SESSION OF THE CONGRESS

authoritative statement of the work that was being done in each field in every country so that even without deliberate collaboration psychotechnicians in different countries might be in a position to pursue the same ends by the same means.

In view of the general agreement that psychotechnical experiment can in general give valid results only when they are made on very large numbers of subjects it was urged that all possible steps should be taken to facilitate the making of strictly comparable investigations in different laboratories.

It was also felt that certain subjects might best be investigated by an international commission. In response to this feeling topics for discussion by a number of commissions were put forward and for those on which the conference agreed a president of the commission was elected. The conference delegated to each president the task of choosing the commission's personnel and that of determining the manner in which it will work.

The Commissions are as follows:

1. Psychotechnical Study of Accidents. Professor Marbe (Wurtzburg).
2. The influence of the Environment on the Worker. Mr. Wilson (Industrial Fatigue Research Board, London).
3. Study of Educability. Professor Claparède (Geneva).
4. The Influence of the Exertion of the Worker on Output. Professor Lipmann (Berlin).
5. The Practical Measures to be Taken to Form a Complete Collection of Existing Tests, with Descriptions of Methods and Results so far Obtained. Professor Piéron, (Paris).
6. An Attempt to Unify the Psychotechnical Vocabulary. Madame Baumgarten (Soleure, Switzerland).

One or two important steps were taken with regard to the organization of the association itself. At a preliminary meeting before the official opening of the conference a tentative plan of fusion of the Association of International Conference of Psychotechnique with the International Association of Psychology and Psychotechnique was put forward. This fusion was voted on in the opening session and it was subsequently decided that the body arising from the fusion should henceforward be known as the International Association of Psychotechnique.

A general "committee of direction" of this association has been set up composed of not more than two representatives of each country.[2]

The Institute of Intellectual Coöperation has placed rooms for the Secretariat-General permanently at the disposal of the association.

Dr. Moeller of Riga has been asked to undertake the direction of an Information Service, by which it is hoped to keep the General Secretariat, and through it members of the association, in constant touch with developments in every country.

The town of Utrecht has invited the association to hold its next meeting there in September or October, 1928. This invitation was accepted by the members of the Fourth Conference but the exact date was not decided.

The proceedings of the conference are being published and members will be informed as soon as possible of the price at which the volume is available.

COMITÉ DIRECTEUR DE L'ASSOCIATION DES CONFÉRENCES INTERNATIONALES DE PSYCHOTECHNIQUE

Membres

Baumgarten-Tramer, F. (Mme.). Docteur en philosophie. Soleure (Suisse).

Bingham, V. Directeur de Personnel Research Fédération, président de l'Association américaine de psychologie appliquée. New York.

Christiaens, A. G. Directeur de l'Office intercommunal d'orientation professionnelle de l'agglomération bruxelloise.

Claparède, Ed. Dr. Professeur à l'Université de Genève.

Corberi, Dr. Asile de Montbello près Milan.

Decroly, O. Professeur a l'Université de Bruxelles.

Ferrari. Professeur à l'Université de Bologne.

Grunbaum, A. A. Dr. Docent de Psychologie à l'Université d'Amsterdam, rédacteur de "l'Administrative Arbeid," chef du laboratoire psychologique à la clinique Valerinsplen.

Joteyko, J. (Mlle.). Professeur de physiologie à l'Université de Varsovic, présidente de la société polonaise de psychotechnique.

Lahy, J. M. Directeur du laboratoire de psychologie appliquée à

[2] The list of members of this committee is appended.

l'Ecole pratique des Hautes Etudes et à l'Institut de psychologie de l'Université de Paris.

Lipmann, O. Directeur de l'Institut de Psychologie appliquée à Berlin.

Miles, G. H. Directeur-adjoint à l'Institut national de psychologie industrielle de Londres.

Mira, E. Directeur de l'Office d'orientation professionnelle à Barcelone.

Moede. Professeur à l'Ecole technique supérieure de Charlottenburg, Directeur de l'Institute de psychotechnique industrielle de Charlottenburg.

Myers, Ch. Directeur de l'Institut national de Psychologie industrielle d'Londres.

Piéron, H. Professeur au Collège de France et à l'Institut de Psychologie de l'Université de Paris, Directeur du Laboratoire de Psychologie physiologique à la Sorbonne.

Roels, E. Dr. Professeur à l'Université d'Utrecht.

Rossolimo, G. Professeur de neuropathologie; Directeur de la Clinique pour maladies nerveuses et de l'Institut neurologique à la 1ère Université de Moscou.

Spielrein, I. Professeur, chef du laboratroire psychotechnique de l'Institut pour la protection du travail à Moscou.

Wojciechowski, J. Ingénieur Directeur de l'Institut Psychotechnique de l'Ecole du Bâtiment et du Bureau des épreuves psychotechniques des chemins de fer à Varsovie.

Secretaire General, J. M. Lahy. Paris.

President (jusqu'a la prochaine conférence). Dr. Toulouse, Ed. médecin en chef directeur de l'hôpital Henri Rousselle, directeur de l'Institut de psychiatrie et de prophylaxie mentale à l'Ecole des Hautes Etudes, Paris.

NOTES AND NEWS

The Fourth International Conference of the New Education Fellowship met at Lacarno August 3 to 15, 1927. The English Report of this World Conference is now ready. Under the general theme, "The True Meaning of Freedom in Education" are the sections: Psychological Freedom, Freedom through Method, through Environment, through Co-Education, through Creative Art and through International Understanding. Among the speakers present were Dr. A. Adler, Prof. P. Bovet, Dr. O. Decroly, Mrs. B. Ensor, Dr. E. Rotten, Dr. A. Ferribière, Dr. Del Manzo, Dr. H. Rugg, Dr. Carleton Washburne, Dr. Lucy Wilson and Sir Jagadis Bose. The price of this English Report is 60 cents. Agents in the U. S. A.—Bookshop for Boys and Girls, 270 Boylston Street, Boston, Mass.

On November 17–18, 1927, under the auspices of Personnel Research Federation a conference dealing with the human factors in industry was held at the Hotel Pennsylvania, New York City. The aim of this conference was to promote scientific investigations of the following: Susceptibility to Accidents and Accident Reduction, Measurement of Leadership, the Personal Interview: Its Technique and Reliability in Fact-Finding, and the Discovery and Measurement of Mechanical Abilities. At the morning sessions there were papers and reports on researches by members of the Federation. In the afternoons groups were formed for round-table discussion on the topics given above. The chairman of the four groups in the order given were Mr. Eugene J. Benge of the Philadelphia Rapid Transit Company; Dr. F. H. Allport, Syracuse University; Dr. Bruce V. Moore, Pennsylvania State College, and Dr. M. S. Viteles, University of Pennsylvania. Col. Walter V. Bingham, Director, Personnel Research Federation, who with Mrs. Bingham traveled in Europe this fall and attended the meetings of the Fourth International Congress of Psychotechnique in October in Paris, will give a paper on Recent Developments in Industrial Psychology in Europe.

Child Labor Day will be observed for the twenty-first year the last week in January, 1928. To make known the facts concerning child labor and to stir the public to demand their correction is the purpose of Child Labor Day—January 28 for synagogues, January 29 for churches, and

January 30 for schools and clubs. The National Child Labor Committee, 215 Fourth Avenue, N. Y., will send free of charge to any interested persons or groups an analysis of the law of their state and other material to aid in the observance of Child Labor Day.

Leland Stanford University announces that Dr. Robert H. Seashore, National Research Fellow in Psychology, has constructed a portable outfit for measuring sensori-motor coördinations. According to Prof. W. R. Miles this apparatus is to be called the Stanford Motor Skills Unit. It includes six tests which make use of the same mechanisms in several different ways. The integrated scores are all read from counters. A motion picture film (16 minutes) has been prepared showing the unit being demonstrated and used.

"The Classification of Pupils in Private Schools." The recent report of the results of a research program conducted by twenty-six schools of The Private School Teachers' Association of Philadelphia throws into sharp contrast the scholastic standards of public schools and those of private schools. The report explains why the same sets of standards cannot be used for both, and sets forth norms for aid in the proper classification of private school students. The sixteen tables included in the report provide norms and ranges for the various grades in chronological age, mental age and educational age. The procedure in using them is described and examples furnished. Price 25 cents a copy. Requests should be addressed to R. C. Clothier, Chairman, Haverford, Pa.

The International Library of Philosophy, Psychology and Scientific Methods has made arrangements with Dr. Horace B. English to bring out a Student's Dictionary of Psychological Terms. It is planned to treat from 2000 to 4000 terms, including particularly those which students are apt to meet as soon as they read beyond elementary textbooks. The work is designed as a defining dictionary, systematically recording actual usage rather than attempting to legislate. The compiler will be very grateful for any suggestions received by the middle of February and addressed to him at Antioch College, Yellow Springs, Ohio.

BOOK REVIEWS

A. Myerson, M.D. *The Phychology of Mental Disorders.* Macmillan Company, 1927. 135 pp.

This little book is somewhat mis-titled, as the point of view of the author is throughout avowedly that of the psychiatrist and not of the psychologist.

The book is written in a style easily comprehensible to the layman. Indeed, it is for the layman that the book is intended. Myerson describes various ones of the ordinary mental disorders, telling something of the underlying causes so far as they are known, and suggests what should be the social attitude in regard to the psychiatric patient. His whole discussion seems to be eminently sane and practical.

While admitting that psychiatry may be of great aid in solving the problem of crime, he insists that psychiatry cannot do it all and that the problem is mainly a social one and not one for the physician.

The book is well worth the reading.

Edward Andrews Lincoln. *Sex Differences in the Growth of American School Children.* Warwick and York, Inc., 1927. 109 pp.

In this little volume, Lincoln has gathered together and summarized practically all of the investigations which have been made on the problem of sex differences of school children. It is to be noted that he limits his discussion specifically to children of school age, and his findings can be extended to adults only as tentative projections.

In general, Lincoln's results are negative; that is, differences between the sexes are not found or are found in such slight degrees that after taking into account the marked over-lapping, no adequate adjustment as to sex is possible. The above statement does not apply to physical growth, in which respect girls are found to be in general physically more mature in every way than boys of a corresponding age. But in intelligence, in school accomplishment, and in variability no significant differences are discovered. The problem of school adjustment is then a problem of adapting to individual differences without respect to sex.

D. Starch. *Educational Psychology.* Revised Edition. Macmillan Company, 1927. 568 pp.

To the one who is already acquainted with Starch's earlier book, little more comment concerning the present volume is needed than to

say that it is written from very much the same point of view and has been brought on the whole very well up to date. The one particular addition is a very brief chapter on Mental Hygiene, a chapter which is probably too brief to be of very great value. In the light of the recent discussions concerning instinct, many would have liked to see the subject treated a little more broadly. Starch's own belief in the uselessness of the discussion, however, is of course warrant toward his neglect of it.

Most of the recent investigations of note in Educational Psychology have found their way into the book. The reviewer feels that the volume would have been of more practical value if some of the standard tests used in the investigations relating to school subjects were of more recent date. In many instances references are made to tests which have long since been supplanted. It is of course a stupendous task to keep up with all of the new tests which are being devised, and a book of this sort should not be expected even to list all of them. However, the statement that "for measuring general merit in written composition *two* scales have been constructed" seems hardly up to date (Italics mine).

As in the earlier edition, a large proportion of the text, approximately forty per cent, is given to the psychology of school subjects, thus reducing the value of the book for a department in which a separate course is given on these topics. For a general course, however, this probably represents the best book available.

D. A. WORCESTER,
University of Nebraska.

JANE HILLYER. *Reluctantly Told.* Introduction by Joseph Collins, M.D. Macmillan Company, New York, 1926. 205 pages.

Miss Hillyer, the sane, intelligent person, is able to stand aside from herself, as it were, and view Miss Hillyer, the psychopath, almost as objectively as though she were viewing someone else. But the sane Miss Hillyer remembers so vividly many of the mental experiences of the insane Miss Hillyer that she is able to give the reader the subjective as well as the objective view. This is a rather awkward way of saying that she is able to describe the experience of going crazy without indulging in self-pity or hysterics about herself. Her account includes much that the serious student of mental pathology would wish to know. Something of her heredity, much of her childhood and early home environment, the breakdown, her hospital experience, long periods of oblivion, an attempt at suicide, returning interests and activities, the return to her own world while yet but precariously balanced, and the long hopeful struggle that, one infers, is still going on to remain normally healthy minded. The writer displays a keen insight into the causes of her trouble, and more particularly the factors entering into her restoration to mental health.

She has a very unusual and very interesting story to tell. She tells it beautifully, simply, and with a touching restraint. Neither confessing nor boasting, she merely relates, and it is in this objective viewpoint that much of the value of the work lies.

In his introduction Dr. Collins, besides assuring the reader of his belief in the genuineness of Miss Hillyer's experience and discussing some of the salient points of her case, presents the psychiatrist's view of how mental abnormality should be regarded.

AMOS C. ANDERSON,
Ohio University.

E. JORDAN. *The Life of Mind.* Charles W. Laut & Company, Indianapolis, Ind., 1925. 324 pp.

Jordan's "Life of the Mind" develops into little more than the author's own rather narrow philosophy of a non-scientific life. The general trend of the book is that belonging to an era that had been buried, supposedly, for at least a decade.

Although following topics that are closely allied to those found in any elementary textbook of psychology, the author disdains to mention practically all of the usual hypotheses except in a most derogatory way, —not for any constructive reason, but seemingly merely because he is violently opposed to anything that may be termed "scientific." In spite of this stated viewpoint we find him turning to the scientific discoveries of physiology and other sciences when an explanation of sensations is desired.

The section devoted to auditory sensations is typical of the whole book. Noises and tones are to be distinguished not because of different characteristics of vibration rate, but merely from the assumption that the human being "likes" tones and "dislikes" noises. Because of this noise association with the automobile, this happy vehicle is referred to by the author as a "spawn of the devil." Could this be a defense mechanism?

Due to its own style, and to its obscure birthplace, the book, fortunately, will have little chance for a popular life. Its contemporaries are those that saw the light of day in the eighteenth century, before the advent of the laboratory. Modern psychology attempts to advance, instead of retard as this book glories in doing, accurate and verifiable explanations of human conduct, or behavior.

S. L. CRAWLEY,
Indiana University.

MEHRON K. THOMSON. *The Springs of Human Action.* New York, D. Appleton and Company, 1927. 501 pp.

An exhaustive literary analysis, of native and acquired "springs of human action" written from the viewpoint of popular psychology. The

experimental approach is conspicuous by its absence. A bibliography of some 250 titles is appended.

CARL E. SEASHORE. *Learning and Living in College.* University of Iowa Studies (Series on Aims and Progress of Research), Volume 2, No. 1, 1927. 124 pp.

A simple, straightforward, non-technical presentation of the outcomes of the author's work on the "Gifted Student Project" under the auspices of the National Research Council, during which he visited over 100 American Colleges. The philosophy of the book may be summed up in the dictum:—"Keep each child busy at his highest natural level of successful achievement and he will be happy, useful and good." Modern mass education is not necessarily antagonistic to recognition of the individual. Individual capacity may best be recognized, motivated and rewarded through some fourteen procedures, which, in the author's opinion represent the cream of the procedures noted by him:—a college qualifying examination, departmental placement examinations, sectioning on the basis of ability, project teaching, honors systems, honors time credit for superior work, elimination of competitive introductory courses in favor of basic courses, ablest teacher teaching basic course, various survey and orientation courses, intellectual comradeship of abler students with faculty, character record and motivation, personnel service, junior college, differentiation of functions of institutions—a majority of which appear in the book as chapter heads. No where at the present time will one find so condensed and so readable an account of the aims and philosophy of so many of the newer movements in college education. All who have an interest in higher education might well be urged to read it.

HERBERT A. TOOPS,
Ohio State University.

KIMBALL YOUNG. *Source Book for Social Psychology.* New York, Alfred A. Knopf, 1927. 844 pp.

This addition to the growing list of books on social psychology will serve primarily those readers who lack easy access to the literature since it contains excerpts from 229 sources. The author presents the subject matter of social psychology through the avenue of the group rather than through the individual. In general, the plan followed is, (1) a consideration of pre-human and human behavior as determined by the group; (2) an exposition of the bases of social behavior as revealed through physiological and psychological studies; and (3) an examination of personality as it develops in group relationships upon the triple foundation of social group, culture, and the individual.

To achieve the above plan the author divides the selections under six main headings: general features of social behavior; psychological founda-

tions of social behavior; personality and social behavior; social attitudes and the subjective environment; leadership and prestige in social behavior; and collective behavior. There are 27 chapters, each with an introductory discussion indicating the problems reviewed and explaining the inclusion of certain selections. Questions and exercises and a selected bibliography follow at the end of each chapter. These introductory discussions and class exercises form an integral part of the volume.

While we are informed by the author that the compilation is *selective* and not exhaustive, and despite the praiseworthy attempt to organize the excerpts under six categories of social behavior, one lays down the volume with a growing conviction that social psychology is an amorphous subject; an affair of theory and little experiment. Admitting that the subject as it now exists is not well-defined we may recognize that this source book is truly representative. We find in it, for example, brief gleanings from the writings of anthropologists, neurologists, professors of education, philosophers, physiologists, political scientists, psychologists, sociologists, and a novelist; the greater number of selections being attributed to the sociologists. Not more than 13 per cent of the articles contain data derived from experiments and case studies, or, regarded somewhat differently, more than 85 per cent of the pages are theoretical in nature. Undoubtedly the number of non-experimental papers written under the title of social psychology is far greater than that representing the quantitative or experimental reports, but the omission from this book of many recent important experimental articles detracts from its usefulness, and contributes to its chief weakness which is failure to exploit the newer psychological approach to the field. Nevertheless, Young's "Source Book," useful to the general reader, is a valuable reference work which promises to supplement the content of courses in social psychology.

CHARLES BIRD,
University of Minnesota.

HARRY J. BAKER. *Characteristic Differences in Bright and Dull Children.* Public School Publishing Company, Bloomington, Ill., 1927. 118 pp.

Before intelligence quotients and mental ages can have much bearing upon our school practices they must be translated from figures into facts. These facts must be stated in terms of aptitude for school work, attitude toward study, methods of learning, rate of progress, etc. This has been done for the subnormal child in several recent books, and to some extent has been attempted for the gifted. The dull and the bright, however, have not received their due share of attention. The author has written this little volume in an attempt to interpret the IQ's which lie between 70 and 90 and those between 110 and 130 in terms of school

work and procedure. The former group he calls "dull" and the latter "bright," and the book is concerned with contrasting these two groups with respect to their natures and behavior in various school situations.

The material which is the basis for the book was obtained by asking five hundred Detroit teachers to report upon these two groups of children with respect to "differences as they expressed them in psychological terminology, upon differences as expressed in their methods of teaching procedures and in any other way they wished." The author tells us that the reports were remarkably unanimous, but he does not summarize them except as he reflects them in the course of the book. At least one reader is disappointed in getting no better view of the original data upon which the book is based.

The opinions of five hundred teachers ought to furnish an excellent beginning on the problem set for this volume, by providing indications of topics on which research might prove fruitful. Opinions, however, ought not to be considered sufficient basis for a treatise on a subject concerning which facts are obtainable. As a consequence of using opinions instead of facts, the author has often been guilty of dogmatism. For this he occasionally expresses regret, but the fault lies fundamentally with the error of using opinions as facts, and seems indefensible to at least one reader. The author has many opinions which are plausible, but others are highly dubious and controversial. For example, in dealing with the problem of special abilities and disabilities, we are assured that a bright child "seldom suffers from a disability," while a dull child with a special disability has a "serious handicap." On the other hand the combination of a bright child and a special talent "furnishes excellent results," but "a special talent is often a liability to the dull pupil." It is doubtful whether such unverified opinions ought to appear in the field of educational literature, especially when verification is possible.

Part II of the book is devoted to the differences of the two types with respect to their work in specific school subjects. Here also we find a great deal of opinion and a very small quantity of fact. We are told that in the social studies that the dull child exhibits a narrow and selfish point of view, while the bright child is the opposite. In music the dull child waits for others to get the pitch or to lead, while the bright child has all the qualities of a good musician. Dull pupils are "inferior in art;" while "work and study in art have always been a natural gift of bright minds." So throughout the book we find many such statements, and most of them are entirely unsupported by experimental evidence. It may well be true that a large number of the opinions are correct, but it is equally probable that some are doubtful and others misleading.

Part III is a brief discussion of how classes are sectioned in Detroit, and some comments on the types of procedures which the author believes to be necessary for each type of child.

JULIA A. KIRKWOOD. *The Learning Process in Young Children.* University of Iowa Studies. Studies in Child Welfare. Published by the University, Iowa City, 1926. 107 pp.

This monograph gives an account of a study of the learning process in young children. It not only makes a contribution to information on how children learn, but also adds to the methodology of experimentation in this field. The various problems studied center around the task of learning a series of twenty associations which the author has cleverly devised. These consist of associations between blocks and pictures which are not too difficult for children above three years (or even somewhat younger), but which are difficult enough so that only one of seven adults of superior mentality made a perfect score on the first attempt. The twenty associations were to be formed within twenty trials, and the associations were declared to be learned whenever the subject could make three perfect performances in succession. The author fully demonstrates that this criterion is much preferable to the more frequent one of a single perfect performance, or even two perfect performances. Furthermore she has shown that requiring more than three successive, perfect performances would be unnecessary. The number of children tested was 203, but for various reasons such as absence, etc., the number of records used in the report is only 180. The precaution of the author in making the conditions of learning standard and in rejecting all cases which did not conform to these standards is highly commendable.

A number of problems were studied: learning on successive days versus learning on alternate days; plateaus; relearning after an interval of a year; transfer and interference of a set of learned associations with a second series of similar associations; differences between children accustomed to psychological tests and those unaccustomed to such tests; correlations between success in learning these associations and success on various intelligence and form board tests; and other points of interest. In all instances the data have been collected and handled with precision and good judgment. The author very wisely refrains from attempting to establish norms for the various age groups, and from drawing inferences and conclusions beyond those justified by the data. Among the things of particular interest to the reviewer was the contrast between paired children, half of whom were learning on successive days and half on alternate days. In spite of the immaturity of the children the superiority of learning on alternate days was clearly demonstrated for this material. Another point of interest was the fact that plateaus occurred more frequently among the less mature children than among the older ones.

The whole study is interesting and well worth the time of any individual interested in this field of experimental work.

STUART M. STOKE,
Ohio University.

NEW BOOKS AND PAMPHLETS RECEIVED*

Books and pamphlets for review should be sent to James P. Porter, Department of Psychology, Ohio University, Athens, Ohio.

The Classification of Pupils in Private Schools. By The Committee on Intelligence Tests of The Private School Teachers' Association, Philadelphia, Pa. Pamphlet No. 2, 1927. 24 pp.

The Effect of Music. MAX SCHOEN. Harcourt, Brace & Company, New York City. $5.00. 273 pp.

An Elementary Psychology—Revised. D. E. PHILLIPS. Ginn & Company, Boston, Mass. $1.72. 420 pp.

Form Relations Group Test. National Institute of Industrial Psychology, 329 High Holborn, London.

Hearing Through the Sense Organs of Touch and Vibration. ROBERT H. GAULT.

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